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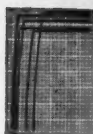
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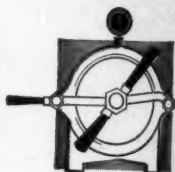
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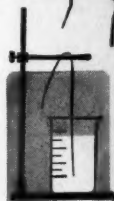
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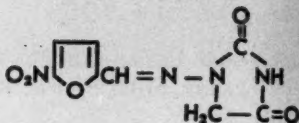
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CONTENTS, OCTOBER

Experimental Vascular Grafts II. Some Undesirable Gross and Microscopic Changes Observed in Arterial Homografts After Implantation Into The Thoracic Aorta of Growing Pigs: A Preliminary Report. EDMUND A. KANAR, M.D., LLOYD M. NYHUS, M.D., EVERETT J. SCHMITZ, M.D., LESTER R. SAUVAGE, M.D., HORACE G. MOORE, JR., M.D., AND HENRY N. HARKINS, M.D., Seattle, Washington.....	915
Surgery as Palliation in The Terminal Malignancy Patient. J. THOMAS PAYNE, M.D., Seattle, Washington.....	924
Treatment of Venous Insufficiency of The Lower Extremities With A Note on The Use of Ascending Phlebography. EDGAR D. GRADY, M.D., Atlanta, Ga., AND E. M. COLVIN, M.D., Spartanburg, S. C.	936
Bile Peritonitis—Sequelae and Treatment. DANIEL L. MAGUIRE, JR., M.D., Charleston, S. C.....	946
Wound Complications Following Surgery. H. THURSTON WHITAKER, M.D., AND JONES W. LAMB, M.D., Vicksburg, Miss.....	953
Surgical Treatment of Patent Ductus Arteriosus. WILLIAM K. SWANN, M.D., AND THOMAS L. LOMASNEY, M.D., Knoxville, Tenn.....	964
Pulmonary Complications Following Upper Abdominal Surgery. FRANK T. KURZWEG, M.D., New Orleans, La.....	967
Surgical Therapy for Pulmonary Coccidioidomycosis. PAUL H. GUILFOIL, M.D., Decatur, Ga.....	975
Surgical Treatment of Degenerative Arthritis of The Hip. FRED C. REYNOLDS, M.D., St. Louis, Mo.....	981
Emotional Aspects of Surgical Practice. CHARLES K. HOFLING, Captain, USAF (MC), Kessler Air Force Base, Miss.....	989
Carcinoma of The Cecum Associated with Acute Appendicitis. ERNEST KIP ROBINSON, M.D., AND RICHARD W. ERNST, M.D., Kansas City, Mo.....	1000
A Review of The Diagnosis and Treatment of Toxic Goiter. LEONARD A. BIBLE, M.D., Jackson, Miss.....	1005
Editorial: Early Operation for Congenital Atresia of the Bile Ducts. THOMAS C. MOORE, M.D., Great Lakes, Ill.....	1012
Book Reviews and Acknowledgements.....	1014

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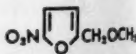
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THE AMERICAN SURGEON

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EXPERIMENTAL VASCULAR GRAFTS. II. SOME UNDESIRABLE GROSS AND MICROSCOPIC CHANGES OBSERVED IN ARTERIAL HOMOGRAFTS AFTER IMPLANTATION INTO THE THORACIC AORTA OF GROWING PIGS: A PRELIMINARY REPORT^{1, 2}

EDMUND A. KANAR, M.D.,⁴ LLOYD M. NYHUS, M.D.,³ EVERETT J. SCHMITZ, M.D.,⁴ LESTER R. SAUVAGE, M.D.,⁵ HORACE G. MOORE, JR., M.D.,⁴ HENRY N. HARKINS, M.D.⁶

Seattle, Washington

The renewed interest in the problems of vascular surgery during the past few years has brought under consideration the behavior of homologous arterial segments as free vascular grafts. The work reported by McCune and Blades (1951), Shumacker (1950, 1951), Marrangoni and Cecchini (1951), Gross (1949), Swan and associates (1950), Callow and Welch (1950), Gerbode (1951), Everson and Southwick (1951), Sauvage and Harkins (1952), Johnson and associates (1951), and Miller and associates (1951), demonstrates clearly that arterial homografts do not show persistence of their cellular elements but rather act as the scaffolding for the ingrowth of connective tissue from the host to provide a conduit for arterial blood. There still remains the need for information concerning the fate of arterial homografts with reference to the combined factors of graft length, anatomic site of implantation, duration of graft preservation, and growth of the host animal. These factors are of obvious clinical importance in young patients requiring replacement of a longer segment of thoracic aorta as, for example, in a coarctation of the aorta with poststenotic dilatation or extensive calcific de-

¹ From the Department of Surgery, University of Washington School of Medicine, Seattle 5, Washington.

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generation at the site of narrowing. This communication is a preliminary report of our observations of certain changes in a small series of arterial homografts of various lengths and preserved for different periods of time prior to implantation into the thoracic aorta of growing pigs.

METHODS AND PROCEDURE

Nine healthy weanling pigs were used in these experiments. All operative procedures were done under aseptic conditions with intraperitoneal Nembutal and supplementary ether-oxygen positive pressure anesthesia. The left pleural cavity was entered through the bed of the resected sixth rib and additional exposure was obtained by transection of a rib above or below the resected one. The aorta was exposed and freed by ligation and division of four to eight pairs of intercostal arteries. Potts coarctation clamps were applied at the cephalad and caudad limits of the exposed aorta, and the desired segment of aorta was excised. Aortic blood flow was promptly re-established by inserting and tying a polished lucite tubular shunt to the cut ends of the aorta as advocated by Hufnagel (1949). A preserved or fresh aortic homograft of appropriate diameter and length (range 2.40 to 10.75 cm. long) was sleeved upon the lucite shunt prior to its insertion into the host aorta. The excised fresh aortic segment was usually anastomosed almost immediately to the thoracic aorta of a companion weanling pig being operated upon by a separate team on an adjacent operating table. The piece of aorta obtained from the second pig was placed in a preservative medium and stored at ordinary refrigerator temperature (4 C.). Delayed type of aortic homografts were preserved from 1 to 243 days in either light mineral oil (3 grafts), or Tyrode's solution and 10 per cent homologous serum medium (1 graft), or Ringer's solution and 10 per cent homologous serum medium (1 graft). Four fresh aortic homografts are included in this report. Grafts measuring less than 5.0 cm. are designated as being of short length.

All except one of the anastomoses were done using the continuous over and over suturing technic with no. 00000 black silk on atraumatic needles. In 1 animal (pig no. 17) a continuous everting mattress suture of catgut was used.* The endo-aortic shunt was removed in all of these animals before completion of the second anastomosis. Measurements of the graft and adjacent aorta were obtained prior to closure of the chest wall. Each animal received depot penicillin (300,000 U.) daily for three days after operation. The pigs were kept in a heated enclosure in the laboratories for approximately two weeks after operation to permit detection of any early vascular complications. Subsequently, the pigs were sent to a farm for the period of rapid maturation which ranged from 187 to 225 days after graft transplantation, during which time the pigs showed a six to sevenfold weight increase. The grafted segment and aorta were obtained from each animal at the time of slaughter or autopsy under the personal supervision of one of the investigators. Two animals died 35 days and 79 days after graft transplantation from nonvascular complications.

* Arterial catgut sutures were made available to us by Mr. Harry Clemens, representative of Davis and Geck, Inc.

The dimensional changes in the grafts were determined by inflation of the graft and adjacent aorta with air at a pressure of 120 mm. Hg. The dimensional changes observed in these grafts are the subject of another report by Nyhus and associates (1953).

Gross inspection and palpation as well as histologic studies of these nine aortic homografts form the basis of this preliminary report.

RESULTS

Gross examination. All nine of the homografts were found patent at death of the animals and apparently served as satisfactory conduits of blood within the



FIG. 1. Roentgenographic appearance of an arterial homograft removed after implantation into the thoracic aorta of a growing pig (no. 45) for 192 days. Radiopacity of the graft is due to the deposited calcium in the walls. Note how the calcification stops at the point of anastomosis indicated by the lead markers.

time limits of our observations (35 to 225 days). No abnormal or newly formed collateral vascular channels were detected in the region of any graft at the time of its removal. There was moderate fibrosis around each graft, but no evidence of calcification in the adjacent host tissues. However, eight of the nine aortic homografts showed various degrees of calcific degeneration. The amount of calcification varied from a minimum of two small plaques (2 mm. diameter) to a maximum of far advanced calcific replacement of the media of the entire homograft. Calcification in all instances was sharply limited to the graft and did not involve the host aorta. Roentgenographic examination of a calcified graft is reproduced in figure 1. It was evident in three of these grafts (from pigs no. 43,

no. 36, and no. 45) that the extensive degenerative changes in the walls had impaired the integrity of the endothelial lining producing small areas of sub-endothelial hemorrhage, irregularity of the surface, and small mural thrombi. The aortic homografts in these instances were converted into friable, rigid tubes (fig. 2). It is interesting that the single homograft (from pig no. 17) with no atheromatous or calcific degeneration had an area of constriction with post-stenotic dilatation. Furthermore, this graft was preserved for a long period of time (243 days in mineral oil) and remained in the animal for a prolonged interval (225 days).

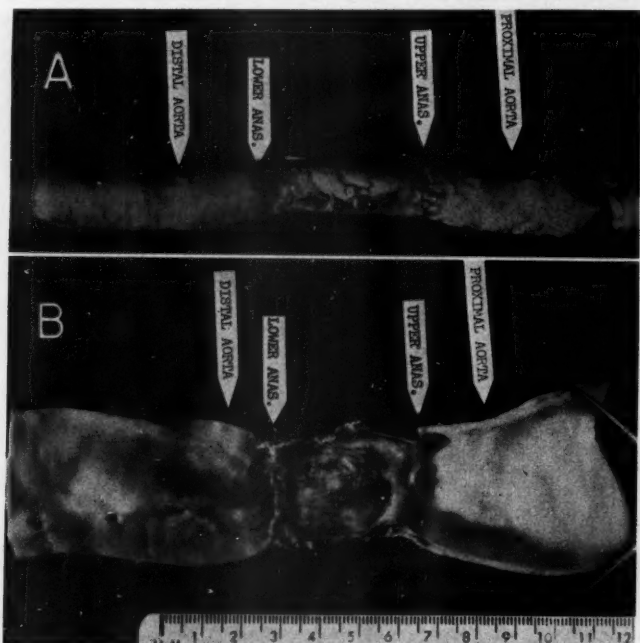


FIG. 2A. External view of arterial homograft removed from pig no. 45 with portion of graft wall resected to show the friable, shell-like calcific deposits.

FIG. 2B. Internal view of graft from pig no. 45 showing the irregular, ulcerated appearance of the internal surface.

Calcification was seen on gross inspection of another graft (pig no. 37) which had been implanted for only 35 days and was fresh at the time of its implantation.

Microscopic examination. No calcific deposits were detected either grossly or microscopically in one of the eight grafts subjected to histologic examination. This graft showed good ingrowth of connective tissue from the host aorta throughout the thickness of its wall (fig. 3). In contradistinction, the homografts which showed calcification had much less connective tissue replacement of the grafted segment. It was also noted that early deposition of the calcium material appar-

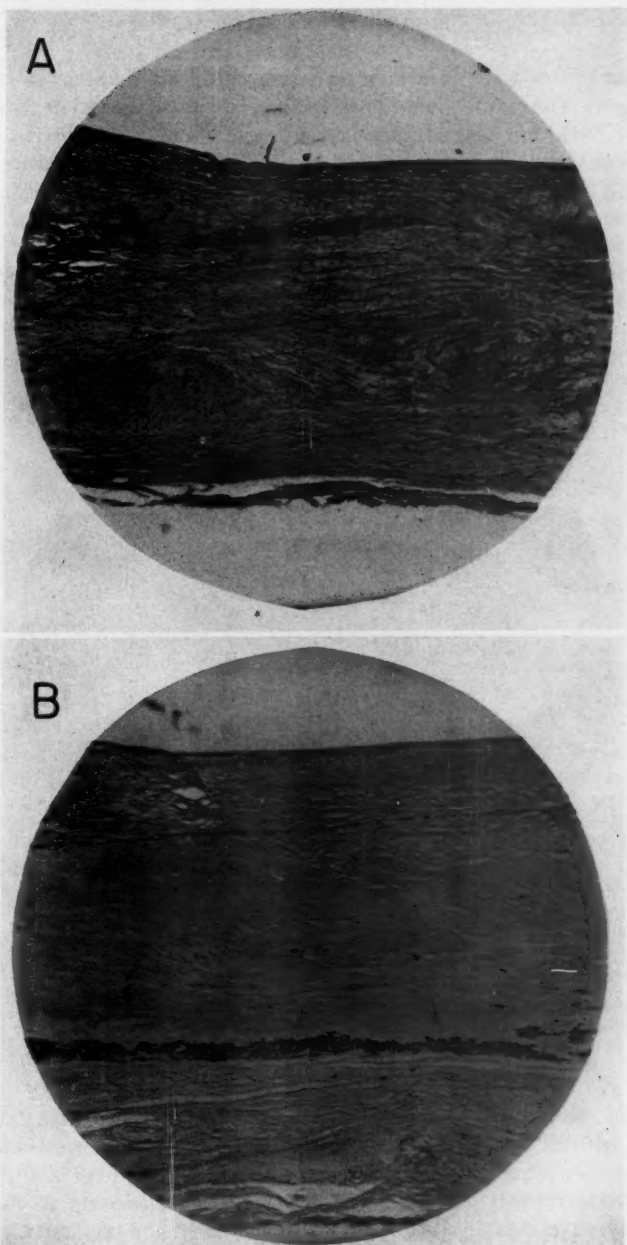


FIG. 3A. Showing the uniform ingrowth of replacing connective tissue from the host animal into the wall of the aortic homograft (from pig no. 17). This graft did not show evidence of calcific degeneration. Intimal surface is at the top of microphotograph (Hematoxylin-eosin stain. Enlargement $\times 70$).

FIG. 3B. Elastic fiber stain (Weigert's) of graft showing the marked distortion and fragmentation of the homograft's elastic fibers (enlargement $\times 70$).

ently occurred upon the persisting densely grouped elastic fibers of the homografts (fig. 4). The elastic fibers appeared to persist in all grafts but with varying degrees of distortion, fragmentation, and loss of staining characteristics. There did not appear to be any relationship between elastic tissue fragmentation and the amount of calcific degeneration. No primary precipitation of calcium crystals upon the endothelial surface of the graft was detected by us, although the grafts with far advanced degeneration showed calcification in all layers of the wall. Calcification was observed in long and short, and in fresh and preserved aortic homografts either on gross or microscopic examination.

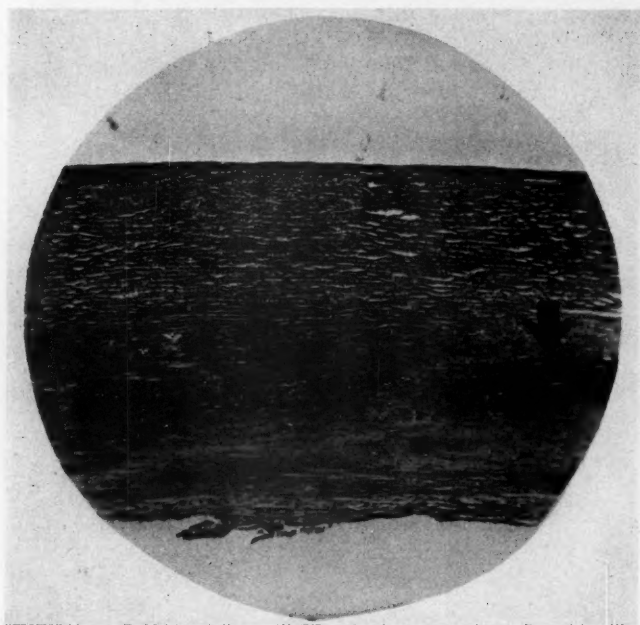


FIG. 4. Aortic homograft from pig no. 37 obtained 35 days after implantation. Calcium crystals appearing as deposits on the persisting elastic tissue fibers of the media (Hematoxylin-eosin stain. Enlargement $\times 70$). Calcium deposits indicated by arrow.

DISCUSSION

Some of the positive factors essential in the study of experimental vascular grafts as outlined by Harkins (1952) have been brought under consideration in this partially completed series of experiments. Although there is a wide variation in the experiments being reported here with relationship to the time of graft preservation, method of preservation, and lengths of the grafts, there were no deaths resulting from vascular graft failures. This finding is in agreement with the studies of other investigators with respect to the functional success of arterial homografts after preservation by a variety of methods. Our microscopic

studies also confirm the belief that aortic homografts undergo connective tissue replacement by ingrowth from the recipient vessel.

Johnson, Kirby and Horn (1952), Gerbode (1951), and Parsons, Gerbode and Cox (1952) have found calcification of short length aortic homografts implanted into the abdominal aorta of mature and growing animals. Our results with aortic homografts implanted into the thoracic aorta of growing pigs (table I) reveal a disturbingly high incidence of calcific degeneration. It is also readily evident from table I that such degeneration took place irrespective of the time or method of graft preservation and of graft length. However, the number of grafts observed is too small to permit any conclusive statements. We are not prepared to make a statistical comparison of calcification in aortic homografts implanted in the abdominal and thoracic aorta, but it seems to us that the latter anatomic site is associated with a much greater incidence of calcific degeneration in aortic

TABLE I

Results obtained with homografts implanted in the thoracic aorta of growing pigs

Pig Number	Type of Graft	Time of Graft Preservation	Duration of Graft Implantation	Length of Graft	Fate of Graft
		days	days	cm.	
21	Aortic homograft	Fresh	79	2.55	Calcification present
37	Aortic homograft	Fresh	35	4.50	Calcification present
17	Aortic homograft	243*	225	2.40	No degenerative changes
45	Aortic homograft	27*	192	3.80	Calcification present
20	Aortic homograft	413†	218	5.35	Calcification present
36	Aortic homograft	1*	187	8.60	Calcification present
52	Aortic homograft	2‡	189	10.75	Calcification present
43	Aortic homograft	Fresh	193	10.10	Calcification present
53	Aortic homograft	Fresh	189	7.00	Calcification present

* In light mineral oil at 4 C.

† In Ringer's 10% homologous serum media at 4 C.

‡ In Tyrode's 10% homologous serum media at 4 C.

homografts. Additional studies are now in progress in our laboratories with respect to these factors so that the behavior of aortic homografts can be more clearly defined.

Our microscopic studies lead us to believe that the initial deposits of calcium make their appearance in aortic homografts upon the elastic fibers of the media. The characteristic intimal lesion of atherosclerosis described very clearly by Duff (1951) and by McLetchie (1952) was not observed by us in our experimental grafts. The changes we detected were more like those described in peripheral muscular arteries and designated as *Mönckeberg's medial sclerosis*. It seems unlikely that the calcification of aortic homografts is due to the process of wear and tear as in *Mönckeberg's sclerosis*. Instead, it may be that such a degenerative change is another indication of the antigenic properties of homologous tissues. The persisting elastic fibers in the wall of the homograft continue to incite a reactive response which the host tissues endeavor to minimize by

calcific encasement. Determinations of the cholesterol-calcium ratio in the homograft, in adjacent segments of the recipient aorta, and in more distant portions of the aorta are being made in the hope of providing some clue to the response of vascular tissues transplanted in a homologous host.

It appears that while aortic homografts function satisfactorily as conduits of blood for relatively short periods of time, they may prove to be unsuitable for use in growing human patients if further studies bear out the preliminary observations reported here. It is hoped that this disquieting report will engender a more intense study of aortic homografts in other laboratories with reference to the host-graft tissue responses.

SUMMARY

Preliminary observations upon the behavior of aortic homografts relative to the site of implantation, length of the homograft, period of graft preservation, and growth of the host are reported.

Calcific degeneration of aortic homografts implanted into the thoracic aortas of growing animals appears to be a frequent complication.

The relationship of graft length and of the time of preservation to the degenerative changes observed is uncertain.

There may be some relationship between the higher incidence of calcium deposition and the manner of connective tissue replacement of the homograft wall.

The degenerative changes observed in aortic homografts may be more directly related to the nature of the antibody-antigen responses of the host rather than to the factors of graft length, or of duration or method of graft preservation.

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SURGERY AS PALLIATION IN THE TERMINAL MALIGNANCY PATIENT

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Seattle, Washington

One of the most trying experiences in life is to care for a relative or close friend whose life is being terminated by malignant disease. The difficulties of such care have been dreaded and met by generations of peoples. Despite the progress of medicine, or perhaps because of it, such experiences are becoming increasingly common.² The care of such people is an intimate and personal thing to many and, as the population age increases, will become so to many more. Certainly the elimination of this tragic experience is a long time off, even though more and more persons are able to receive curative treatment.

It is not the purpose of this paper to discuss a definitive or curative program, but rather to outline certain experiences in the application of surgery to the handling of the patient who is beyond the range of curative procedures,—the so-called *terminal case*.

This discussion is based upon over 100 (table I) such patients admitted within the past 18 months to the Surgical Service of the Veterans Administration Hospital in Seattle, Washington. These patients were in all stages of their disease, but most of them had had some attempt at definitive therapy prior to seeking hospitalization. They represented a cross section of the veteran population. The average age was 58.8 years, the youngest being 32 and the eldest 82. The only single feature common to all was the fact that every physician examining them agreed that no further curative measures could be applied with any hope of success.

The general attitude at the examination of these patients on admission was dictated by the answers to the following questions:

1. Have all possibilities of a cure been exhausted using all available surgical, radiological, and chemical modalities?
2. If all such measures have been exhausted what were the patient's presenting symptoms which caused him to seek hospitalization, and what measures could be applied to relieve these symptoms?

Irrespective of the origin of the patient, every patient who was admitted for so-called *terminal care* received such examinations as seemed to be indicated. These included the routine hematological work-up, urinalysis, and such special roentgenograms as seemed appropriate. After these studies, if all examiners believed that nothing definitive seemed indicated, all further efforts were directed towards alleviating the patient's symptoms.

Reviewed by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions of the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

* From the Department of Surgery, School of Medicine, University of Washington, and the Seattle Veterans Administration Hospital.

The palliative treatment of these patients was directed primarily towards the relief of their symptoms and secondarily towards rehabilitation, if even for a very brief period. The goal was to send a symptom-free patient home for such care as was available there, and if possible restore him to a self-supporting state.

TABLE I

Classification of primary tumor of patients admitted to the surgical service with incurable malignancy

System or Organ Involved	Patients		Results of Treatment		Status		
	No.	Percentage (Approx.)	Good	Poor	Alive	Deceased	
						Autopsy	No Autopsy
Oropharynx							
Tongue.....	5	5	4	1	2	3	
Pharynx.....					1		
Floor of mouth.....	2	2	2			2	
Trachea.....	1	1	1			1	
Lung.....	21	20	17	4	5	13	2
Gastrointestinal Tract							
Esophagus.....	1	1	1			1	
Stomach.....	8	8	3	5		5	3
Colon:							
Right.....	3	3	3		1	2	
Transverse.....	2	2	2		2		
Rectosigmoid....	11	10	8	3	2	7	2
Biliary tract							
Gallbladder.....	2	2	2			2	
Bile Ducts.....	1	1	1			1	
Pancreas.....	4	4	4		1	3	
Genito-urinary							
Kidney.....	2	2	1	1	1	1	
Ureter.....	1	1	1			1	
Bladder.....	2	2	2			2	
Prostate.....	14	13	9	5	5	3	6
Testes.....	4	4	3	1	1	3	
Breast.....	1	1	1		1		
Sarcoma.....	6	6	3	3	3	3	
Melanoma.....	2	2	2			2	
Skin.....	1	1		1		1	
Undetermined primary...	10	9	7	3	7	2	1
Total.....	104		77	27	32	58	14
Percentage.....		100	74%	26%		69%	

To achieve these goals it was necessary to carefully analyze the symptoms which the patient presented, and to try to correlate them with his organic disability. It was noted that the symptoms fell into three general categories, as listed in table II.

It was difficult to separate the symptom etiology into such general categories,

however, for purposes of therapy this seemed to be a practical approach. Certainly, it was quite usual for the patient with intestinal obstruction, which is essentially disturbance of function, to have sensory disturbances and pain. The pain attributable to intestinal obstruction is usually quite different from the pain brought about by the invasion of bone by tumor. The mechanical presence of a tumor can introduce many types of symptoms, but often these are attributable to the presence of the tumor as such. Under this category we have chosen to place the large fungating lesion which—by its presence, as on the face, lip, or groin—produces a mechanical disability that the patient is unable to overcome.

TABLE II
Symptoms of patients with incurable malignancy

Disturbance of function	
Obstruction of	
Gastrointestinal tract.....	20
Biliary tract.....	6
Urinary tract.....	8
Blood flow to extremity.....	2
Cerebrospinal fluid circulation.....	2
Respiratory tract:.....	12
Dyspnea	
Pneumonitis	
Anemia and infection of severe degree.....	3
Mechanical disturbance	
By sheer mass of tumor.....	12
By ulceration, infection.....	5
Pathological fractures.....	5
Sensory and other subjective disturbance	
Anxiety and/or suicidal attempts.....	2
Parasthesias.....	3
Paralyses.....	4
Coma.....	2
Pain.....	30
Weakness.....	7

The second largest number of symptoms fall within the sensory and subjective category. These are largely pain, and it is this group which has received the most serious attention by many observers.

RESULTS

In assessing the results of a therapy program for a condition such as is under discussion, it is difficult to find a yardstick to determine the efficacy of treatment. The entire problem is an individual one—for every patient—and is often one of assessing the attitudes of the family as well as of the patient. Certain measures can be applied with respect to the length of the hospital stay. It has been possible to make the over-all hospital stay for this group of patients 35 days. There is little basis for comparison of this time other than that in other

comparable institutions the hospital days range between 40 and 90 days. Hospital stay, however, is often colored by the ability of the family to care for the patient who may be a semi-invalid, as well as the patient's actual wish to leave the hospital. Perhaps an index of the family's approval of the therapeutic regime might be their willingness to grant postmortem examinations. This again is difficult to use as a criterion, however, it is significant that, of the group of patients who have died during this period of treatment, 79 per cent have had a postmortem examination.

More difficult to assess is the patient's own satisfaction with his treatment. Of the entire group of over 100 such patients, only 1 was so dissatisfied with his treatment that he left against medical advice. This unfortunate person returned subsequently to end his days in this hospital. Table III gives a summary of the results as assessed by the criteria mentioned.

TABLE III

Comparison of results of palliative treatment of 105 patients with incurable malignancy on a surgical service

Treatment Program	Assessed Results		Status	
	Good	Poor	Alive	Autopsy
Medication:				
Hormonotherapy, chemotherapy and analgesia.....	22	17	10	15
Surgery for functional or mechanical disturbance.....	45	9	21	35
Surgery for subjective disturbances..	10	1	1	8
Totals.....	77	27	32	58

Of the patients who presented themselves because of a disturbance in function, the most common types were those with intestinal obstruction and those with biliary or urinary tract obstruction.

In the broad sense of the word nearly all of the symptoms of malignancy requiring hospital treatment are from disturbances of function. However, more strictly applied, the disturbance of function can be attributed to an obstructing lesion, usually of the biliary or gastrointestinal tracts, the urinary tract, or the tracheobronchial tree.

A simple way to assess the treatment of each symptom complex is by case illustration.

CASE REPORTS

Case 1. A 38 year old elevator operator complaining of a dull epigastric pain, nausea, vomiting, and jaundice, was admitted to the Seattle Veterans Administration Hospital in early July 1951. He had had a right pneumonectomy at another Veterans' hospital six months previously. On examination he was found to be deeply icteric and showed evidence of weight loss. He was in fairly good condition. The right hemithorax was dull to percussion; the trachea was deviated to the right, as was the mediastinum. The abdomen was slightly

distended; the liver was palpable, tender, and regular of surface. The gallbladder was greatly enlarged. Laboratory examination showed fair liver function, but a high blood serum bilirubin was reported. A chest roentgenogram showed absence of the right lung. A gastrointestinal series, including a barium enema, showed no abnormality other than the enlarged liver.

It was believed that this patient probably had an obstructive jaundice attributable to metastatic carcinoma. An exploratory laparotomy was done in early September, confirming this diagnosis. The gallbladder was greatly distended. A cholecystogastrostomy with entero-enterostomy was done with prompt relief of the symptoms and the jaundice. The patient was discharged on his eighteenth hospital day, and he returned home to his family. He remained quite comfortable and free of icterus and gastrointestinal disturbances, but failed to gain weight. He required one splanchnic block for control of pain. He was readmitted to the hospital in late September 1951 because of extreme cachexia, and some pain. Opiates were required twice each day. He died quietly on his eighteenth hospital day. Postmortem examination confirmed the original impression of carcinomatosis, metastatic, from the lung.

Comment: This patient was extremely uncomfortable and in much distress because of his obstructed biliary tract. The carcinoma per se was not causing him pain. It was believed that his last few months were made more comfortable by the short-circuiting of the biliary tract, and certainly his care was much simpler for his family and the hospital.

Case 2. A 59 year old government employee, was admitted to the Seattle Veterans Administration Hospital on Oct. 4, 1951. An epigastric mass was palpable which, at exploration, was found to be a huge carcinoma of the stomach infiltrating the liver, adjacent pancreatic tissue, the duodenum, and the retroperitoneal tissues. Because this patient's symptoms were severe vomiting and retching, a high ante-colic gastro-enterostomy was done. He made a rapid postoperative recovery and was soon eating a regular diet. He was discharged three weeks after his admission, his family having been advised of his condition. For two months the patient was able to continue without any symptoms other than progressive weakness and weight loss. During this period he visited his children in the vicinity and attended to his personal affairs. He spent his last few weeks with friends under the most ideal of circumstances, despite the fact that hospitalization was offered him during this period. He re-entered the Seattle Veterans Administration Hospital in late December, his only complaint being weakness and pain from a perforation of the buried wire stay sutures through his skin. The sutures were removed. The patient required only two injections of demerol during the three days of hospitalization prior to his death.

While this is a common problem to the general surgeon, there are some who leave these people without a short-circuiting procedure at the primary operation. It has been our impression that a gastro-enterostomy frequently can offer them much relief from the distressing vomiting and retching which occurs. Certainly it worked well for this patient.

Table IV shows the number of cases in which some type of procedure was done for disturbance of function and the type of procedure.

A tumor may be attended by pain, as well as disturbance of function, but occasionally only the mass is disturbing by the fact that it is a huge ulcerating area which requires constant care.

Case 3. A 61 year old mechanic, entered this hospital in January 1951, complaining of a mass in the left axilla. The mass prevented his wearing a prosthesis on his left arm. The

patient had had an amputation of his left arm in the mid-humeral area at another hospital for a squamous cell carcinoma found in the distal end of the radius. He previously had had a carcinoma removed from the bladder. An exploration had been done of the left kidney

TABLE IV

Type and number of technics used for palliation of patients with incurable malignancy

Medication (without surgical intervention):	
Analgesia alone.....	19
Hormonotherapy.....	8
Chemotherapy.....	1
Biopsy and medication alone.....	3
Operative procedures:	
Decompressive procedures	
Gastro-enterostomy.....	2
Cholecysto-enterostomy.....	3
Entero-enterostomy.....	1
Revision of colostomy.....	2
Transurethral prostatic resection.....	5
Gastrostomy.....	1
Tracheotomy.....	2
Excision of symptomatic mass:	
Gastrectomy—palliative.....	4
Cholecystectomy.....	1
Right and transverse colectomy.....	2
Pneumonectomy.....	1
Excision of ulcerating tumor.....	8
Amputation—Forequarter.....	1
Exploration (operative and peritoneoscopic) in hope of relief.....	15
Hormonosurgery—orchietomy.....	7
Plication of perforation of gastric carcinoma.....	1
Surgery for pain and subjective symptoms:	
Nerve blocks.....	5
Peripheral neurectomy.....	2
Tractotomy.....	2
Decompressive laminectomy.....	2
Prefrontal leukotomy.....	5
Exploratory and decompressive craniotomy with or without internal decompression.....	3
Reduction of fractures.....	5

because it was slightly hydronephrotic, but nothing important had been found. The right kidney showed minimal hydronephrosis as well, but clear urine was shown.

Examination at the time of admission revealed a cooperative healthy man with a missing left arm. There was a tangerine-size mass in the left axilla which was attached to the skin. It seemed to be freely movable, and certain observers believed it was growing rapidly. Roentgenograms and laboratory examinations were unimportant. A retrograde pyelogram

showed bilateral hydronephrosis with extremely poor function on the right side. Nothing of importance was seen in the bladder on cystoscopy, nor was the urine from the right kidney remarkable. It was decided that the mass in the axilla should be excised to remove its difficult form, as well as to eliminate the danger of ulceration. This was done by a radical axillary dissection. On section the mass was found to be a metastatic squamous cell carcinoma in the axillary nodes. The postoperative course was benign. It seemed to us that he had a diffuse carcinomatosis, probably the primary lesion being in the left kidney or ureter.

In May 1952, he re-entered the hospital because of pain in the right testis and groin. This pain was relieved by the resection of a dilated, carcinomatous ureteropelvic junction, but recurred in one month. The pain did not respond to nerve blocks or section. The patient refused cordotomy and died after two months of treatment with narcotics.

Comment: This illustrates the problems brought about by a disabling mass in the axilla. He was by no means cured of his disease, nor was his life prolonged; however, it was made more convenient. The presence of the mass was the only thing that really bothered him. The question of a primary renal tumor was of no interest to him, until it produced symptoms. His final treatment was unsuccessful from a palliative point of view, yet the patient and his family were content with the care.

The symptoms which are largely sensory in nature constitute the largest group. These can be in the nature of sensory disturbances, paresthesias, or pain of varying degree.

Sensory disturbances: A common site of metastatic carcinoma is the spine. Here there may be all manner of paresthesias, depending upon the site of the tumor.

Case 4. A 58 year old realtor, had developed numbness and tingling of the legs with subsequent paralysis, in June 1950. He had had two laminectomies, the most recent one having showed a metastatic carcinoma. He was referred to the Seattle Veterans Hospital for terminal care because he had once more lost the use of his legs. There was no particular pain. Upon admission the patient was found to be in a good state of nutrition, but totally paralyzed in all modalities below the fifth thoracic segment. There was an old laminectomy scar between the scapulae. There were huge decubitus ulcers over both greater trochanters. The urine was grossly infected. Roentgenograms of the spine showed an osteolytic process in the bodies of the third and fourth thoracic vertebrae, with compression fracture of these bodies. In September 1951, an exploratory laminotomy was done removing a metastatic carcinoma encircling the spinal cord at the level of the third thoracic vertebra. This decompression was followed by 2400 r of roentgen irradiation to the upper thoracic spine. Sensation and motor function returned rapidly. The decubitus ulcers over both greater trochanters were closed primarily. The patient was discharged in four months, and he was able to walk with a brace to support his head and back. Repeated studies of all systems failed to reveal the primary tumor. Eight months later, he was still wearing the brace but had lost 2 inches in height. He had driven his car and trailer 3000 miles and was feeling fine.

Pain is the most important symptom associated with advanced malignancy. It is against this symptom that much of the effort of palliation is directed. The oldest attack on pain is with analgesic medications. In addition to the analgesics, certain hormonal and chemical preparations are available which diminish the pain by various actions. Examples of this latter group are the nitrogen mustards, the estrogens used for carcinoma of the prostate and the androgens used for

carcinoma of the breast. It is our belief that all of these nonanalgesic substances should be used first for the treatment of pain. If a specific chemical or hormonal agent is not applicable or effective in the relief of pain, the analgesics can be used.

Such substances as intravenous procaine, alcohol, and procaine amide may have lasting effects in the relief of certain types of pain. If these fail, the less powerful narcotics such as codeine and demoral may be used. It is our opinion that the more powerful narcotics and those requiring parenteral administration should be reserved as the last resort treatment. Narcotic addiction should be avoided when possible.¹ Once a patient is addicted he is very nearly inaccessible for other more lasting palliative measures. The following case is an example of extreme narcotic addiction.

Case 5. A 57 year old waiter had had a right pneumonectomy at another hospital for carcinoma of the lung in May 1950. For eight months prior to admission he had complained of pain in the right chest and the right side of the face, and down the right arm. He had been treated with narcotics and nerve blocks. On admission he was found to have a severe pharyngitis. The right chest was flat to percussion; the trachea and mediastinum were deviated to the right. Roentgenograms of the chest showed the right lung to be absent. Detailed search failed to reveal any evidence of recurrent or metastatic malignancy. He failed to respond to blocks of the stellate ganglion and intercostal nerves. He was severely addicted to narcotics, and finally left the hospital after two months, still taking the drug.

He was readmitted three months later, deeply cyanotic with depressed respirations and minute pupils. He had lost some weight and his family stated that he had not been eating. Again there was no evidence of recurrent tumor. The narcotic addiction was broken with much difficulty and distress to the patient. He became ambulatory, gained weight, and was again discharged after one month—pain free and a decidedly different man. He was readmitted eight months later, having slipped back into his old habits again. The addiction was again broken with good immediate results.

Comment: This patient, though an extreme case, illustrates the danger of assuming that a painful state is due to carcinomatous extension. It also illustrates the dangers of narcotic use at too early a date. Because of the addiction this man would not respond to block therapy on his first admission. After the addiction had been broken, he required only an occasional placebo.

Case 6. W. J. B., a 53 year old dishwasher, had been treated elsewhere for a carcinoma of the floor of the mouth with palliative doses of external irradiation. An early recurrence with spread down the neck and up into the orbit had occurred. He was an alcoholic, so it was not surprising that he left the hospital against advice after a few days of local treatment with improvement. He was readmitted two months later, complaining of severe pain in the right side of the face, loss of vision in the right eye, and a right proptosis. He was emaciated. The right eye was closed by facial edema, and upon examination he was found to be blind. A dirty intra-oral ulcerating mass extended through the cheek and upper neck. It was not possible to relieve the inflammatory reaction by antibiotics. He was most pathetic. Realizing his inherent weakness for alcohol, a regime was set up consisting of 15 cc. of whiskey before meals, with 0.03 Gm. of codeine. This strange combination of medications kept the patient quite comfortable except for hunger. Ten days before his death a gastrotomy was done under local anesthesia. He was able to take all medications this way and his hunger was alleviated. The patient died quietly and in no pain.

Comment: It was fortunate for us that we were able to control this man's symptoms by such simple measures. The fungating oral carcinoma is one of the most difficult lesions to treat because of the revulsion that many personnel get for these patients.

Area dissections offer an excellent method for the control of well localized pain, especially when a demonstrable tumor is present to define the field of therapy. This is illustrated in the next case report.

Case 7. A 66 year old steward entered the hospital in late July 1951. He had had a right colectomy done elsewhere a year previously. During the four months prior to admission he had had increasing pain in the skin and abdominal wall on the right and 40 pounds loss in weight. On admission the pain was so severe that he refused examination of the area. There was a visible mass in the region. His general condition was satisfactory, despite an inactive right upper lobe tuberculous infiltration. A barium enema showed a functioning ileotransverse colostomy. An attempt was made to resect the mass in the right abdominal wall. This was unsuccessful because of extension down into the pelvis and into the flank. However, the mass was circumscribed in its symptomatic area, with consequent complete relief of pain. The patient was discharged in one month but returned in three months with more pain lateral to the area excised. He had also an ischiorectal abscess at that time. His general condition was fair. The abscess was drained and the right ilio-hypogastric and ilio-inguinal nerves were sectioned under local anesthesia. He was again discharged symptom free. Two months later he re-entered the hospital because of a bout of transient intestinal obstruction. This responded to intubation overnight. It was found that the fibrosis in the right pulmonary apex had broken down and cavitation was developing. The patient was free of pain and wanted to go home. He was referred to the care of a tuberculosis sanatorium. The abdominal mass was huge by this time.

Comment: This man responded surprisingly well to local attack on the recurrent tumor. He was one of the most grateful patients that we have had.

The well done peripheral nerve block is one of the most important techniques in the control of pain. Present day anesthesiologists have developed skills that are extremely effective in alleviating pain in a given area. The following case report illustrates this type of treatment.

Case 8. A 56 year old realtor had had an abdominoperineal resection for a carcinoma of the rectum. He entered the Seattle Veterans Hospital for the first time 18 months after this resection, complaining of severe perineal pain radiating into the groin and scrotum. His colostomy stoma was contracted and had caused him some discomfort. Upon examination he seemed to be in good condition. The liver was palpable. There was hyperesthesia over the perineum. A chest roentgenogram showed several large pulmonary masses, which were interpreted as metastases. A procaine block of the lower three sacral nerves at their outlet from the sacrum was done with relief of the pain. The colostomy was revised under local anesthesia, thereby relieving the slight abdominal distention that was present. The patient went home, quite comfortable. He returned in a month, extremely dyspneic, but pain free. The chest roentgenogram showed virtually no uninvolved lung. Aminophylline by vein and rectum alleviated the dyspnea to some degree. The patient died on the eighth hospital day.

Comment: This patient illustrates the effectiveness of simple procedures in the control of pain. No narcotics were necessary. The blocks were quickly and easily done with no discomfort to the patient. The colostomy revision added comfort without inconvenience. Several patients so treated were the most satisfactory of the entire group.

It is important that the individual wishes of the patient be respected in any palliative regime, if at all possible. Some patients so fear pain that they wish a more permanent procedure than nerve block or area dissection. In some patients simple measures are not applicable. For these people cordotomy is the next step. The following case is illustrative.

Case 9. A. E., a 60 year old man, had had two laparotomies elsewhere for carcinoma of the rectosigmoid. He entered the Seattle Veterans Hospital complaining of severe perineal pain and some abdominal distention. He was thin but in fairly good nutritional state. There was a large low abdominal mass. The colostomy stoma was stenotic and the abdomen distended. A large presacral tumor was felt on rectal examination. Sacral nerve blocks were done with procaine, with complete relief of the pain. The patient was advised that an alcohol block could be done but might have to be repeated in a few weeks. Cordotomy was also discussed with him. He elected the latter procedure. A bilateral spinothalamic tractotomy was done at the second thoracic segment with complete relief of the pain and no complications. The colostomy stoma was revised under local anesthesia. The patient went home two weeks after the cordotomy. He returned in a month complaining of painless hematuria. On cystoscopy a large metastatic ulceration was found in the bladder. This was fulgurated and the bleeding stopped. The patient was again sent home, quite comfortable but obviously in a poor state of health.

Four months later he re-entered the hospital with severe pain in the back and right shoulder, unrelieved by large doses of morphine. He was cachectic and miserable. The liver was huge, and a large tumor was visible in the left supraclavicular fossa. Another mass was palpable in the pelvis. A bilateral prefrontal leukotomy was done. His pain largely disappeared, as well as his profound mental depression. The clinical course was unchanged however, with death ensuing from multiple carcinomatous fistulas between the skin, bladder, and bowel. Autopsy showed extensive carcinomatosis.

Comment: This patient illustrates the application of tractotomy and leukotomy to the pain problem. A well done tractotomy may be attended by some sphincteric complications, but the benefits sometime out-weigh the inconvenience. The patient should understand the risks. The discomfort of the operation is quite negligible with present day anesthesia technics. It is an excellent palliative procedure and deserves much more popular application. The leukotomy probably should have been done first in this man, however, he outlived the estimated time of his survival.

On occasion the pain from malignancy cannot be localized for various reasons. The patient may approach a psychosis in his reaction to the pain or to his disease. His agitation may attain such a degree as to cause him to attempt suicide. Such severe pain and attendant reactions are fortunately not too common, but when they occur they cause great distress to all concerned in the care of the patient. In such unfortunate people either an intra-cranial tractotomy or a prefrontal leukotomy is about the only procedure which will offer any benefit. Some of these patients, e.g. the patient with primary lesions about the head and neck, or the prostatic carcinoma with diffuse spread, may have a long period of survival prior to their death. In such persons prefrontal leukotomy has been done with excellent results. An illustrative case is here reported.

Case 10. A 53 year old farmer, was first admitted to the Seattle Veterans Hospital in early summer of 1951 complaining of inability to void. It was found that he had a carcinoma of the prostate with bony metastases. A bilateral orchiectomy with a transurethral resection

was done. He developed considerable back pain, but went home in the late summer, taking codeine for the pain. He did fairly well until Dec. 21, 1951 when he re-entered the hospital because of severe back pain and hematuria. On examination he was found to have spotty anesthesia over the legs and extreme tenderness over the pelvis and lumbar spine. The hemoglobin was 8.7 Gm. per cent and the urine was grossly bloody. Roentgenograms of the spine and pelvis showed metastatic lesions of the vertebral bodies, pelvis, and proximal shaft of the right femur. The hematuria responded to Foley catheter drainage of the bladder. The pain was intractable despite estrogens, sedation, and morphine. The patient was offered a leukotomy and while he was thinking this matter over suddenly attempted suicide by incising his wrists and neck. The lacerations were very superficial. The family and the patient agreed to prefrontal leukotomy, which was done bilaterally on Jan. 2, 1952. The patient was immediately pain free. He withdrew from his environment for one day, then gradually resumed a calm, normal personality. He was no longer agitated. He did require help with eating but walked about the ward and was no longer a serious nursing problem. One month postleukotomy he suddenly died while watching a television show. No autopsy was permitted.

Comment: This patient responded very satisfactorily to a bilateral leukotomy. He was made uncomfortable for about a day after the operation, but the family believed that the treatment was worthwhile despite his brief life span after the operation. The suicidal attempt vividly brought out the distress that such events precipitate in the patient and in his family. It is our belief that everything possible should be done to prevent such incidents.

DISCUSSION

From a review of such a group of patients it is possible to derive certain conclusions, even though statistical analysis is difficult or impossible. The approach to the patient is perhaps the most important of any single factor. The clinician must first of all be sympathetic towards the problem, no matter how trying the circumstances. His sympathy may serve to convey the attitude of optimism upon which so many of these people depend. It seems to us that whether a patient knows that he has malignancy or not is not the serious issue. The issue is whether he knows his prognosis in terms of time and suffering. It is here that the physician is able to convey an attitude of optimism and sympathy with great truth and conviction. The patients for whom nothing can be done to relieve either their symptoms or mental anguish are so few as to be nonexistent in our series.

To accomplish such a program of treatment, it is important to educate the family and friends of the patient in the nature and course of the patient's disease. One should strive to instill a bright outlook in their minds, for nothing will depress a patient more than having his family mope around shaking their heads in discouragement. All too often even the professional staff caring for the patient must be encouraged. The patient with incurable malignancy is placed in a room with others of his type and called a *terminal*. He will be visited irregularly on rounds or not at all. The nursing and nonprofessional personnel will absorb this attitude and soon the patient group in that area becomes depressed by the sheer weight of social attitude. Other patients learn that when they are moved to this room, or are admitted into *the room* that nothing further will be done for them.

This is indeed a dismal situation and is simply remedied by a little encouragement of the staff. If these patients are kept comfortable they will appreciate the comradeship of others in an open ward.

As important in the attitude expressed to the patient is the aggressiveness of the therapy. It is essential in this respect to balance the good that the patient will derive from the treatment against the discomfort of the treatment. If surgical intervention seems in order the operative technic should be of the best to reduce postoperative discomfort. The surgeon must spare no pains in his work and thus must give freely of his time. Palliative surgery is time consuming and expensive, and the gain is often small. The goal is not to prolong life but to make it more livable. Our figures suggest (table III) that the over-all mortality rate is not much different whether palliative surgery is used or not, although there was one death within 24 hours after a prefrontal leukotomy. The old axiom of *Primum non Nocere* should be applied here as in all other fields of surgery.

It has been the tradition of the medical profession, supported by the American people, to give generously of their time and effort to the sick. The treatment of the final stages of malignancy falls within this scope. It is proper to expect all specialties to collaborate in these problems, but it is often difficult to gather all groups together in a close therapeutic unit. The large public clinical unit is ideally suited for this cooperative effort. At the same time these hospitals should be used only as hospitals, for if an active palliative program is carried out the patient should be based at his home and supported by the hospital. There is no room for a place where the cancer patient is sent to die in our present day hospital system. The patient with incurable cancer is a family responsibility first, and it is then a function of his neighbors and friends, acting through the hospital systems, to help him.

CONCLUSIONS

The patient with incurable cancer is a difficult problem and one which sorely taxes the skill of his attending physician. He is at once a problem in mental and physical illness.

A few examples of various combinations in technics have been given from a surgical service. It has been the experience of our group that palliation with an optimistic attitude offers much to this patient.

Addiction to narcotics can largely be avoided by judicious use of hormone-therapy, irradiation therapy, and surgical measures. The most important single admonition has been to help the patient more than he is hurt.

No attempt has been made to cover the individual technics in detail. It is hoped this may be done in subsequent studies.

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TREATMENT OF VENOUS INSUFFICIENCY OF THE LOWER EXTREMITIES WITH A NOTE ON THE USE OF ASCENDING PHLEBOGRAPHY

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There is no unanimity of opinion as to the method of choice in the treatment of venous insufficiency of the lower extremities. We think that the best procedure is not to use a single, stereotyped method, but rather to apply the particular therapeutic procedure that is suitable after an individual evaluation of the entire involved extremity has been made. This evaluation cannot be confined to a single vein or system, but should include the deep venous system, the greater and lesser saphenous systems, the arterial supply, secondary infections, and the state of the sweat glands. Accordingly, we have developed a comprehensive program for the evaluation and treatment of the deficiencies of the venous return from the lower extremity. Several special points which we have found to be of unusual help are emphasized.

GENERAL PLAN OF TREATMENT ACCORDING TO CLASSIFICATION OF DISEASE

Small varicosities—whether primary or residual after previous therapy. These varicosities usually are asymptomatic. However, it is often desirable to treat them for cosmetic reasons or to make previous treatment complete. Such varicosities may be treated simply by injection of sclerosing agents into the lumens of involved veins. A varix is not injected if there is existing phlebitis or other local complication. Our practice is to treat only one varix at the time of the first injection, in order to minimize the effects of sensitive reactions. We prefer a 5 per cent solution of sodium morrhuate for the sclerosing agent, using 1 to 2 cc. at each site and limiting the total quantity used in one day to 8 cc. The patient is placed in either the sitting or erect position to distend the vein. Then 1 cc. of air is aspirated into the syringe with the sclerosing agent; the skin is prepared and the needle is inserted into the lumen of the vein. The air is first injected into the varix and is followed by the sodium morrhuate. The air pushes the blood out of the vein lining to produce a more complete and permanent obliteration of the lumen with a minimum of thrombosis. A small ball type of dressing is immediately applied as the needle is withdrawn. It is important that the patient walk after injection.

There is a very small expected mortality rate following injection therapy.

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Nunn and Harrison⁶ reported a mortality rate, accumulated from various sources, of 0.0177 per cent following injections. The majority of the deaths followed pulmonary embolism. These authors added 1 such case. Dean and Dulin⁴ recorded two similar deaths and recommended ligation of the saphenous vein prior to injection treatment to decrease the likelihood of pulmonary embolism. Even after ligation of the saphenous vein, the route of passage of an embolus from superficial vein via the communicators and deep veins still remains. However, if one exercises the precautions described above, he will greatly reduce the probability of embolism.

Extensive varicosities without incompetent perforators. If it is found that fairly large and extensive varicosities do not fill when a tourniquet is placed just below the fossa ovalis, interruption and ligation of the great saphenous vein and all its tributaries at the sapheno-femoral junction is done. Similarly, a tourniquet test may indicate that the short saphenous vein should be ligated. Occasionally it may be found that there are only one or two incompetent communicators along the course of the saphenous veins, in which case it is usually elected to do interruption and ligation of the veins in these places at the same time or following ligation of the upper end of the main trunk.

Varicosities with multiple incompetent perforators. These problems are handled by the same ligation procedure with added stripping out of the saphenous trunks and available superficial tributaries. We have successfully used the extraluminal and the intraluminal stripper in a large number of patients. Fragile veins are difficult to remove with the extraluminal stripper, but short superficial tributaries are best removed with an outside stripper. The intraluminal stripper is used for greater ease and speed in removing the entire saphenous trunk. There are two methods of using the latter: 1) The vein may be inverted into itself as it follows the stripper. The small tip of the stripper is passed through the vein lumen in a retrograde fashion at the time of the high saphenous ligation. When it is passed as far as possible (usually to the ankle), a nick is made in the skin over the distal tip, and the vein is opened to bring out the tip. The proximal end of the stripper is now fitted with an acorn tip of a size smaller than the vein lumen. The vein is transected, the proximal end is ligated, and the distal vein containing the stripper is tied to the stripper just below the acorn. The distal end of the stripper is pulled to invert the vein into itself, as the vein is pulled out of its bed. 2) The second method is to pleat the vein in an accordion fashion as a large acorn tip on the proximal end of the stripper pushes the vein inferiorly when the stripper is pulled from below. In this case, the proximal end is fitted with an acorn tip of a diameter greater than that of the vein lumen. The pleating is less likely to tear the main vein in two; has a lesser likelihood of losing the vein from the stripper; and shears the communicators more cleanly. Accordingly, the larger acorn tip is recommended.

In some cases the tortuosity of the veins, their postphlebitic changes, or the arrangement of the valves will make it difficult to pass the small end of the intraluminal stripper retrograde as far as desired. The saphenous vein usually may be exposed through a small incision at the ankle. In such a case, the stripper

may be more easily passed—small end first—from the ankle to the open end of the great saphenous trunk in the upper thigh incision to reverse the entire stripping procedure.

During and after vein stripping, the patient's lower extremities should be elevated. This aids in giving the patient a more comfortable postoperative course because of less extravasation of blood into the soft tissues. It is also a good prophylactic measure against postoperative phlebothrombosis and pulmonary embolism. Immediately after the completion of the operative procedure, elastic bandages are applied from toes to groin for the same reasons. Ambulation is advised 24 hours after operation.

Incompetent deep veins. When incompetent deep veins are present in association with varicosities, the varicosities are treated first. Additional conservative treatment used is: primarily wrapping with elastic bandages or the use of elastic stockings, modification of activity, and local therapy of ulcers and infections. Fungus infections receive particular attention. Notwithstanding all these measures, disability may persist. If such a patient has a true postphlebitic leg—verified by phlebogram as described below—the popliteal vein is exposed just above the popliteal fossa and is transected and ligated. Elastic support is continued indefinitely and the patient is advised that he must adjust his activity to the tolerance of his legs. Improvement—not cure—is all that can be expected for this type of case.

Results in 6 patients in whom the popliteal veins were ligated have been gratifying. Only 1 of these has been observed for over two years. The other 5 are only a few months postoperative. Each patient apparently has been benefited by popliteal vein ligation. In all of them ulcers have healed or greatly improved. Similar good results are reported in 80 patients by Bauer.¹

Obliterated deep veins. The usual occurrence after deep vein thrombosis is recanalization with loss of valves. There are a few patients, however, in whom the veins fail to recanalize, which can be determined with certainty only by ascending phlebograms. In such patients there are always superficial varicosities. There is little help to give these patients, but occasionally elastic bandages or stockings will be tolerated and are then recommended. Adjustment of the patient's activity and attention to local lesions conclude the suggested treatment.

TREATMENT OF ASSOCIATED AND SECONDARY COMPLICATIONS

Edema and/or fibrosis. Increased venous pressure and anoxia of venous and capillary walls resulting from chronic venous stasis may produce extravasation and accumulation of fluid in the tissue spaces. Fibrosis with or without inflammation may follow. Elastic compression of the leg, increased rest with elevation of the feet, and treatment of the veins as described above will each aid in decreasing the edema.

Pigmentation. From causes producing edema, there may be extravasation of cellular elements of the blood. The pigmentation of the tissues, produced by deposits of hemosiderin from the breakdown of red cells, is a frequent precursor to ulceration. The treatment is the same as for edema.

Ulceration. Ulcers are often secondarily infected with fungi and/or bacteria. Complete bacteriologic studies, including tissue cultures for fungi, are made and the offending organism is treated appropriately. When an underlying vein communicator with an incompetent valve system is feeding the ulcer, the vein is dissected out and ligated deep to the fascia. Ulcers less than 1 inch in diameter will usually heal with rest. Larger ulcers may require split thickness grafts, after excision of poor granulations and indurated margins. Persistent and recurrent ulcers may require pedicled grafts either from a good leg or *stepped* down from the abdomen when the skin of both legs is poor. Full thickness pedicle grafts are especially useful when there is osteomyelitis underlying an ulcer.

Bursting pain. The patient with incompetent valves in his deep venous system has a pooling of venous blood in the muscle body of this leg, which produces a typical bursting type of pain when he is on his feet. This will usually occur rapidly when the patient changes from a lying to a standing position. The treatment for this complication is as described for incompetent deep veins.

Recurrent thrombophlebitis. There are a few patients who have recurrent thrombophlebitis which appears to result from chronic infection of the feet. These patients are apt to have severe hyperhydrosis and associated chronic fungus infection. Lumbar sympathectomy will produce a dry warm foot in which the fungus infection is more easily controlled. We have had 2 such patients for whom sympathectomy was done. Both have had very effective results.

ASCENDING ERECT PHLEBOGRAPHY

For accurate evaluation of methods used in treating lower extremity venous insufficiency, the exact pathology must be understood. Roentgenographic visualization of the veins removes any doubt of the extent and type of pathology that may exist after clinical evaluation. We have explored several different methods of phlebography of the lower extremity and have found that ascending erect phlebography, as described by Scott and Roach,⁸ is most satisfactory. The following are the usual indications for such phlebography: (1) severe varicosities, (2) doubt as to etiology of varicosities, (3) previous surgical failure in treating varices, (4) physical findings of thrombotic sequelae, or a history of thrombophlebitis.

Method of making phlebogram.

1. The patient is tested for sensitivity to diodrast.
2. He is then placed upon a roentgenographic table with a foot rest, the table being elevated to 75 to 80 degrees.
3. The roentgen ray tube is placed at the same angle.
4. The leg to be examined is placed in the mid portion of the table and internally rotated about 25 degrees.
5. A tourniquet is placed just above the ankle to occlude superficial veins and force dye into deep veins.
6. A no. 20 gauge needle is inserted into one of the dorsal veins of the foot.
7. The needle is connected by a short plastic tube to a syringe containing 25 to 30 cc. of 35 per cent diodrast.

8. Contrast medium is injected rapidly—but not forcibly—over a period of 5 to 10 seconds.
9. In some patients with large venous beds, more diodrast is advised (30 to 50 cc.).
10. Roentgenograms are taken without haste.
11. Have adrenalin available for treatment of rare reactions.

Value of the phlebogram. 1. All the incompetent communicating veins between deep and superficial systems are demonstrated. Their locations may be exactly transposed to the patient so that in the treatment of the varicosities none of the important communicators will be *missed*. An incompetent communicator feeder to an ulcer may be exactly located and treated accordingly.

2. The presence or absence of a functioning deep venous system may be established.

3. The postphlebitic incompetent deep venous system may be demonstrated. In this case there will be no competent valves; there will be a ragged, irregular contour to the lumen of the deep vein, and there may be a myriad of deep, small veins of irregular character.

4. A normal deep system of veins may be demonstrated. The vein lumen will be smooth and wide, and good valves will be easily seen.

CASE REPORTS

Case 1. Fig. 1. A 55 year old white male farmer had a three year history of large varicose veins in the right leg. Examination revealed large, dilated, tortuous veins on the medial side of the right lower leg. There was clinical incompetency of the valves of the superficial system. A phlebogram of the right leg showed competency of the valvular structures of the deep and communicating veins.

This patient was treated with high and low saphenous ligations and stripping, resulting in complete eradication of the varicosities.

Case 2. Fig. 2. A 25 year old white service station attendant had a history of varicose veins for six years. He had a large ulcer over the anteromedial aspect of the left lower leg which had been present for six months and had failed to heal. There were edema and induration around the ulcer. Clinical tests were confirmed by phlebogram, which showed normal deep veins with abnormal filling of the greater and lesser saphenous systems, indicating incompetent communicating veins. Directly under the ulcer on the medial aspect of the lower leg a large incompetent communicating vein was noted. Multiple ligations were done. At the sapheno-femoral junction the long saphenous and all its neighboring tributaries were transected and ligated, and each incompetent perforator vein was also transected and ligated. The latter included ligation, beneath the deep fascia, of the communicator feeding the ulcer. Varicosities disappeared and the ulcer healed.

Case 3. Fig. 3. This is another phlebogram to demonstrate normal deep circulation with incompetent perforating veins and superficial varicosities. The valvular structures of the deep veins are well demonstrated. This patient was treated with ligation of the greater saphenous vein and ligation of the perforating veins to the greater saphenous. The varicosities disappeared.

Case 4. Fig. 4. A 52 year old white man had no definite history of chronic thrombophlebitis but had clinical evidence of it. Phlebograms showed absence of competent valves in the deep veins, numerous incompetent communicating veins, other abnormal collateral channels, and superficial varicosities.



FIG. 1



FIG. 2

FIG. 1. Competency of the valvular structures of the deep and communicating veins
 FIG. 2. Normal deep veins. Incompetent communicating veins, including a vessel directly deep to a large ulcer.



FIG. 3



FIG. 4

FIG. 3. Normal deep circulation with incompetent perforating veins and superficial varicosities.

FIG. 4. Absence of competent valves in deep veins, incompetent communicating veins, other abnormal collateral channels and superficial varicosities.

He had ligation and stripping of the superficial veins, followed in two months by ligation of his popliteal vein. He has shown considerable improvement.

Case 5. Fig. 5. A 35 year old white man had a history of bilateral acute thrombophlebitis with bilateral superficial femoral vein ligations five and a half years previously. He continued to have chronic edema and pain in both legs. His phlebogram bilaterally showed complete absence of deep circulation. All the contrast media was visualized in the superficial veins.

This patient was fitted with full length elastic stockings and treated conservatively. There has been only moderate decrease in edema and pain.



FIG. 5. Complete absence of deep circulation

Case 6. Figs. 6 and 7. A 25 year old white man gave a history of bilateral thrombophlebitis seven years previously. He had pain, edema, and large varicosities. Phlebogram demonstrated the anterior and posterior tibial groups of veins to be well visualized but more tortuous and irregular than normal. A few functioning valves could be seen notwithstanding the evidence of previous thrombosis. Several incompetent communicating veins were also noted. The popliteal vein was not adequately filled, and recanalization of that structure was suggested.

This patient was treated with operation directed at his superficial and communicating veins. Pain and edema have moderately decreased and no varicosities are demonstrable.

Case 7. Figs. 8 and 9. A 35 year old Negro man had findings of a postphlebotic leg. He had had a left groin abscess at the age of 16 years. Ten years later he first developed swelling of the leg and thigh. At that time filariasis, to which he had been exposed, was suspected but was never proved. Swelling persisted, followed by brawny induration and ulceration extending to 8 cm. in diameter over the left lateral lower leg surface. Phlebograph of the leg demonstrated irregular ragged margins of the deep veins and absence of com-



FIG. 6



FIG. 7

FIG. 6. Tortuous and irregular anterior and posterior tibial vein groups
 FIG. 7. Poor filling and ragged appearance of popliteal vein



FIG. 8



FIG. 9

FIG. 8. Irregular ragged margins of deep veins and absence of competent valves in deep and communicating veins.
 FIG. 9. Complete block at junction of left femoral and external iliac veins. Dye fills dilated tortuous superficial epigastric veins.

petent valves. A pelvic phlebogram made by injection of dye in a superficial vein of the thigh showed a complete block at the junction of the left femoral and external iliac veins.

Pinch grafts to the ulcer failed to grow. Popliteal vein ligation was done at which time a thickened recanalized vein was found. There was gradual clinical improvement after this operation. Swelling decreased and the ulcer healed. Follow-up is only four months.

CONCLUSIONS

We believe that the correct treatment for venous insufficiency of the lower extremities is to use not a single standard method but rather to evaluate carefully each patient's entire involved extremity and then apply the appropriate therapeutic procedures. A program to guide the physician in this evaluation has been developed. Special points which have been of unusual help are summarized briefly below.

1. Ascending erect phlebography by use of 35 per cent diodrast injected into the foot vein is an easily done procedure which may be of great help in evaluating problem cases of venous insufficiency of the lower extremity.

2. Ligation of the popliteal vein is apparently beneficial when done in a carefully selected postphlebotic patient.

3. Very small primary and residual varicosities are best treated by injection with sodium morrhuate after first replacing the blood in the varix with a small quantity of air.

4. More extensive varicosities without incompetent communicating veins are best treated by high ligation of the involved saphenous vein and its upper tributaries.

5. When communicating veins between the deep venous system and superficial varicosities have incompetent valves, they should be interrupted either by stripping procedures or separate ligations.

6. Careful search should be made for such an incompetent communicating vein feeding an ulcer of the leg. When found, it should be ligated deep to the fascia.

7. During—and for 24 hours after extensive vein surgery of the lower extremity—it is recommended that the foot of the table or bed be elevated to prevent bleeding into the tissues and as a prophylactic measure against phlebotrombosis.

8. Secondary infections in ulcers of legs having venous insufficiency are frequently derived from epidermophytosis. This should always receive vigorous treatment.

9. Recurrent thrombophlebitis associated with severe hyperhydrosis and chronic epidermophytosis is benefited by lumbar sympathectomy.

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BILE PERITONITIS—SEQUELAE AND TREATMENT

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Bile peritonitis is the reaction of the peritoneum to free bile within the peritoneal cavity. Survey of the literature seems to indicate that the condition is comparatively rare, and the paucity of reports of the clinical aspects of the problem in the American and English literature has been remarked upon by all observers who have undertaken to review the subject. However, one may assume that many more cases have occurred than have been reported. This is probably because the condition usually represents a disastrous complication of an elective procedure which some surgeons may regard as a surgical stigma. If, therefore, by this discussion a little more light may be shed on the management of this distressing problem, some unhappy patient and the still more unhappy surgeon may be benefitted.

A number of causes in the production of bile peritonitis have been indicted. The commonest etiologic factor in most instances, and the one with which we are chiefly concerned in presenting our case report, is rupture of the common bile duct. Less frequently, bile peritonitis may follow leakage from accessory hepatic ducts after cholecystectomy, perforation of the gallbladder, or as a result of rupture of the liver or extra hepatic biliary system either by intra-abdominal injury, such as stab or gun shot wounds, or extra-abdominal injury from a blow or a fall.

Usually, the biliary soiling of the peritoneal cavity is sudden and unexpected. Seldom is the peritoneum forewarned of the impending contamination, and thus protective confining adhesions are rarely in evidence to limit the rush of the bile to all the quadrants of the abdomen. As with a ruptured duodenal ulcer, the patient's peritoneal surfaces are flooded with a chemical irritant within a short time. Added to this is the fact that probably in the majority of cases the bile is infected, so that the surgeon is confronted with a suddenly, desperately ill patient who is convalescing from a cholecystectomy and/or choledochostomy, and who has a superimposed septic generalized peritonitis. It is quite clear why observers quote a 60 per cent mortality rate figure as the cost in lives due to this complication.

Rupture of the common bile duct with resultant bile peritonitis may occur at any time after cholecystectomy or choledochostomy. Brunschwig² reports the shortest period as 12 days, the longest $3\frac{1}{2}$ years.

The most important single factor producing rupture of the common duct is increased intraluminal pressure produced by a common duct stone, spasm or carcinoma of the sphincter of Oddi, chronic pancreatitis, nonfunctioning common duct tube, or stricture. Of these, the overlooked stone is the most common

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cause, statistically accounting for 90 per cent of the cases. Less frequently, infection of—or around the duct wall—necrosis due to mural thrombi, slough of the cystic duct stump or injury to the duct by operative trauma may result in perforation of the common duct. A number of cases of bile peritonitis have been described^{2, 9, 13} in which no gross perforations of the bile ducts were demonstrable, and in which the pathogenesis remained obscure.

The clinical picture is rather typical regardless of the cause, and the possibility should immediately come to the mind when such a syndrome is presented in a patient who has had biliary surgery in the recent past. Classically, in the acute phase, the symptoms consist of a sudden onset of severe upper abdominal pain accompanied by varying degrees of vascular collapse, tachycardia, dyspnea, cyanosis, high leukocytosis and sharp temperature rise. Abdominal tenderness and rigidity is at first confined to the upper abdomen, but soon becomes generalized. Paralytic ileus with marked abdominal distention follows in 12 to 24 hours. Icterus may or may not appear, and is seldom a prominent sign.

If the patient is among the fortunate 40 per cent who do not die during the acute period of this complication, he may pass into the subacute or chronic phase. After the first three days, the bile tends to be walled off and localized and may become encysted above or under the liver, in either lateral abdominal gutter or in the pelvis. If the bile is not pocketed by adhesions, a chronic form of peritonitis develops. Since bile is an irritant, its salts injure the capillary walls, causing permeability and an out-pouring of plasma. It has been said that a few cubic centimeters of concentrated bile, free in the peritoneal cavity, causes an exudation of several hundred cubic centimeters of liquid. Therefore, the chronic form of bile peritonitis may simulate ascites due to carcinomatosis, hepatic cirrhosis or tuberculous peritonitis.

Since the outcome is almost certainly fatal without operation, the abdomen should be opened at the earliest moment the diagnosis appears probable. The bile is evacuated; drains inserted; and, if feasible, the common duct is intubated. The patient is supported with the routine peritonitis regimen with intestinal decompression, antibiotics, parenteral fluids and vitamins, blood transfusions and sedation. It is wise not to use morphine since this drug tends to increase sphincter spasm.

The two principal sequelae of the peritonitis are chronic external biliary fistula and chronic adhesive peritonitis. Chronic external biliary fistulas rarely heal spontaneously, but usually continue to drain copiously until they are closed surgically. However, if there is no actual organic blockage of the common duct, a certain number of these cases will gradually heal, although 12 to 18 months may elapse before all drainage ceases. It was, no doubt, because of this slow, natural closure in a small proportion of cases that Sir David Wilkie¹ was prompted to remark that *the ultimate criterion of high aptitude for a surgical career was not dexterity of hand or brilliance of intellect, but the ability to see weekly for six months a patient with a biliary fistula and never mention the word bile*. We are forced to conclude from the experience of others that, although the surgeon may become impatient and anxious to effect a quick cure of the fistula by surgi-

cal intervention, such cases should be observed and masterful inactivity instituted to continue for several weeks to months. Even though obstruction may be demonstrated by cholangiograms, the physician's hopes for a spontaneous cure may be bolstered by the possible existence of a chronic pancreatitis or a spastic spincter of Oddi which might be expected to subside in time or respond favorably to medical therapy. The most important sign that spontaneous healing could possibly be expected is the presence of bile in the stools, even though intermittently and in small quantities. During the period of observation of the fistula, the patient should be given bile salts and vitamin supplements by mouth lest he develop osteoporosis and hemorrhagic tendencies.

Should cholangiograms reveal a persistent common duct stone producing blockage of the common duct below the internal opening of the fistula, it is strongly advised that the tract be injected with ether and alcohol. This procedure has been shown to be successful in many cases in producing fragmentation and dissolution of residual common duct stones.¹⁴ We have used daily instillations of equal parts of ether and 95 per cent alcohol, followed by 1 per cent novacaine in warm olive oil with complete satisfaction. The ether-alcohol mixture fragments the stone, the oil lubricates the duct, and the novacaine dissipates the usual attendant sphincter spasm. Disappearance of the stones and resumption of the normal biliary flow frequently occurs after four or five days of treatment, but cases have been reported in which daily injections for several weeks were necessary before the desired effect was obtained.

When it finally becomes obvious that spontaneous healing of a biliary fistula may not be expected, surgical exploration is indicated. If a stone is encountered, it should be removed, and the duct intubated for several weeks. If a stricture of the duct is proved to be the cause of the continued drainage, the strictured area is excised and, after mobilization of the two ends, the duct continuity is re-established by end to end anastomosis with T tube drainage.

The other sequela of bile peritonitis, chronic adhesive peritonitis, apparently presents problems less frequently than biliary fistulas, but nevertheless the threat of intestinal obstruction is a real and grave one, and ever present during the resolving phase of the peritonitis. If obstruction develops, it usually involves the first and second parts of the duodenum, but, of course, may twist or angulate any part of the intestinal tract. Frequently, this complication may be simply overcome by freeing the bowel from the adhesions, but occasionally gastro-enterostomy or entero-enterostomy to by-pass the obstructed segment may be the wiser procedure when the adhesions are very dense and cannot be safely dissected away from the bowel.

The following case report illustrates some of the complications and difficulties of treatment that may be encountered in bile peritonitis:

CASE REPORT

L. J. H., a 57 year old white man, was admitted to the hospital on Nov. 5, 1950. For about a year, he had been troubled with upper abdominal pain, nausea and pyrosis after meals, particularly after ingestion of foods high in fat content. He had never had jaundice. The past history was essentially negative. Roentgenograms of the stomach, duodenum and

gallbladder revealed the stomach and duodenum to be normal, but the gallbladder functioned poorly and contained a large calculus. The physical examination was not remarkable except for the presence of a pulsatile mass in the abdomen just below the umbilicus which was thought to be an aortic aneurysm. Preoperative electrocardiogram, roentgenograms of the chest, and kidney function tests were all normal. The Wassermann and Kline tests were negative.

He was operated upon on November 8, through an upper right paramedian incision under general anesthesia. The gallbladder was thick walled and adherent, and contained a large stone about 4 cm. in diameter. The stomach, duodenum and pancreas appeared normal. The common duct was not dilated, the bile was of normal color and stones were not palpated. There was a fusiform aneurysm of the abdominal aorta about 8 by 10 cm. in size just above the bifurcation. The gallbladder was removed in the routine way without any unusual difficulty. A small catheter was passed through the common duct into the duodenum by way of the cystic duct stump without meeting any obstruction. The cystic duct stump was then doubly transected and ligated with chromic no. 0 catgut, and a Penrose drain was passed through a lateral stab wound. The appendix was removed.

The patient enjoyed a satisfactory, uneventful postoperative course during the first four postoperative days. On November 12, four days after operation, he was taking a full diet; the bowels were moving normally; the abdomen was soft and flat; the temperature had returned to normal, and he was ambulatory without complaints.

On November 13, the fifth postoperative day, he was suddenly seized with severe upper abdominal pain. When seen a short time after the onset, he was groaning and crying out, apparently in extreme discomfort. The blood pressure was 90/55; the pulse was 118 and of small volume, and the respirations were grunting and labored. The abdomen was slightly distended in the upper half, and generally tender throughout with voluntary muscle guard. No masses were palpable other than the aortic aneurysm which was unchanged. The pulsations in the legs were normal. The temperature was 98 F.

A Levine tube was inserted into the stomach, and a large quantity of liquid and gas was evacuated with some relief, leading us to hope that the startling change was due to acute gastric dilatation, rather than other more serious complications. Parenteral fluids and aureomycin were again started. He was given pantopon for pain and 500 cc. of blood. The blood pressure returned within a few hours to the preoperative level, and remained stabilized thereafter.

During the next 48 hours, the general condition continued to improve. The temperature remained normal; the pulse ranged around 80 per minute, and the patient seemed to be relatively free of pain. Peristalsis was resumed, and the gastric suction was discontinued. Liquids were begun by mouth which were well tolerated. There was a high leukocyte count for several days.

On November 16, three days after the pain began, the drainage site, which had healed, began to drain bile copiously encouraging us to assume that there had been a spontaneous evacuation of a pocket of bile, and that further drainage procedures would not be necessary. However, the drainage soon diminished and stopped, and a day or two later the patient began complaining again of pain in the region of the liver, radiating through to the back and up to the right shoulder. Roentgenograms and fluoroscopic studies of the chest and diaphragm made on November 17, revealed elevation and limitation of motion of the right diaphragm with a fluid level beneath the diaphragm. There was also partial atelectasis of the right lung.

On November 18, the right posterior subphrenic space was entered after resection of the twelfth rib, and about 500 cc. of clear bile evacuated and drains were inserted. Notwithstanding this, the patient experienced no relief of the pain in the upper right part of the abdomen, and he continued to be generally tender in this region, although no definite masses could be made out. The abdomen remained slightly distended, but peristalsis was active. There was no fever, and the pulse was not unusually rapid. The posterior subphrenic incision had drained a little for two or three days and then stopped draining. The blood count remained elevated. On November 20, repeat roentgenographic studies revealed the right

diaphragm still elevated and fixed. Barium studies of the stomach and duodenum showed no apparent abnormality or displacement of these organs.

On November 22, we were able to define a large mass which seemed to occupy most of the upper right abdominal quadrant and epigastrium. On that date, through a subcostal approach, a tremendous pocket of bile was entered, and about 3,000 cc. of bile were evacuated. The bile extended up over the anterior and superior surfaces of the liver, subhepatically, and into the right lumbar gutter. The accumulation appeared to be walled off from the remainder of the peritoneal cavity. No attempt was made at this time to approach the common duct because of the precarious condition of the patient.

From November 22, to December 8, the picture was that of a chronic biliary fistula with gradually progressive pyloric obstruction. Weight loss continued. An estimated 2,000 cc. of bile in each 24 hours drained through the wound. As time went on, he was able to take less and less by mouth because of increasing signs of high intestinal obstruction. He was in no great pain at this time; was afebrile; the pulse was normal, and the bowels moved regularly, but he was losing weight rapidly and dehydration was marked. The blood count had returned to normal. The icterus index, which had risen to 29 units on November 24, had also returned to normal. During this period he was supported with 3,000 cc. of 5 per cent glucose in amigen daily, frequent blood transfusions, bile salts and parenteral vitamins. The blood chlorides, potassium and protein estimations remained within satisfactory range.

Roentgenograms of the stomach made on December 8, revealed marked distortion of the prepyloric antrum and high grade obstruction at the pylorus. After five hours, 75 per cent of the barium was still retained in the stomach. Since there was a question that the patient may have developed a gastric ulcer to account for this obstructive phenomenon, he was given a Sippy diet regime and belladonna in large doses.

For the next month, there was no marked clinical improvement. He was ambulatory and free of pain, but the profuse biliary drainage continued, and he progressively lost weight and strength regardless of all supportive measures. He was uncomfortable only when he over-ate, and he learned that he could eat only one meal a day without pain and vomiting. Repeated stool examinations revealed bile to be present intermittently.

On December 28, the fistulous tract was injected with 60 cc. of Lipiodol (fig. 1). A large, irregular pocket was outlined extending upward almost to the dome of the right diaphragm and apparently high up on the posterior surface of the liver. After a time, Lipiodol began to progress toward the duodenum, and at least a small quantity of the dye seemed to enter the bowel. At the same time the cavity was injected; barium was given by mouth to show the relation of the cavity and fistula to the stomach and duodenum. The stomach did not empty at all for four hours, but the barium began to slowly trickle through the pylorus after this time, and the stomach was completely free of barium in 24 hours. The continued irregularity and stenosis in the prepyloric area, and near the common duct, were thought to be due to external inflammatory changes. Gastric analysis revealed an absence of free hydrochloric acid, and only 10 per cent total acidity.

About two weeks after injection of the fistula, the biliary flow slackened very markedly and within three or four days had ceased completely. The fistula healed over quickly, and the stools resumed a normal color. The patient never complained of pain, nor did he have jaundice. For about two and one-half months, he had no symptoms of biliary obstruction, but continued with symptoms of pyloric stenosis. Since the fistula healed, dehydration was not so marked, but he was still losing about one-half pound a week. He could eat one good meal and take about 1,000 cc. of liquids daily, but more than this quantity brought on pain and vomiting. Repeated roentgenograms of the stomach revealed no improvement in the degree of gastric retention. Since there had been no spontaneous improvement in the duodenal obstruction in four months, we believed that surgical intervention was indicated.

He was readmitted to the hospital to be prepared for gastrojejunostomy, when he suddenly developed jaundice, which rapidly increased in intensity. He was referred elsewhere

for further diagnosis and treatment. At operation, a stricture of the common duct and a choledochoduodenal fistula was found. The fistula was dissected out and closed; the strictured portion of the duct was excised, and the duct was anastomosed. T tube drainage was used. It was also noted at this time that there was a large ulcer in the prepyloric portion of the stomach on the posterior wall. Because of the precarious condition of the patient, resection of the stomach was not done. He enjoyed a satisfactory, uneventful postoperative course, and within six weeks his jaundice had completely disappeared.

Subsequently, because of continued symptoms of pyloric obstruction, he was again operated upon, and a partial gastric resection was done. The ulcer proved to be an adenocarcinoma, but there was no evidence of regional or distant metastases, and so the prognosis, from this standpoint, was thought to be reasonably good.



FIG. 1. The biliary fistula was injected with lipiodol and barium was given by mouth. Note collection of lipiodol in the right upper abdomen. The pylorus was almost completely obstructed.

SUMMARY

Bile peritonitis is a serious complication of biliary surgery most commonly due to rupture of the common duct. It should be suspected in anyone who presents signs of generalized peritoneal irritation with varying degrees of collapse following cholecystectomy and/or choledochostomy.

If the patient survives the acute episode, the condition may continue into the subacute or chronic phase, characterized by localized bile collections and/or partial or complete intestinal obstruction due to adhesions.

Biliary fistulas following drainage of localized pockets frequently will heal spontaneously. If not, excision of the tract, with the diseased portion of the com-

mon duct, may become necessary. Obstruction, usually seen in the duodenum or upper jejunum, may require mobilization or anastomosis around the involved segment of bowel.

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WOUND COMPLICATIONS FOLLOWING SURGERY

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For the purpose of this communication, the records of 500 consecutive patients having laparotomies relatively recently at the Lutheran Hospital have been examined to determine the incidence and types of wound complications; to analyze the factors seeming to predispose to these complications and, where possible, to determine how to prevent or, if that be impossible, how best to manage the complications.

Of these 500 patients having abdominal section, a wound complication of minor or major degree occurred in 7.4 per cent of the patients. Disruption of the wound occurred in 8 cases, an incidence of 1.6 per cent. Infection occurred in 17 cases, an incidence of 3.4 per cent. Hernia followed in 3 cases, an incidence of 0.6 per cent. Hematoma was noted in 5 cases, an incidence of 1.0 per cent. Partial skin separation occurred in 4 cases, an incidence of 0.8 per cent. Draining sinuses occurred in 2 of the 5 cases in which tantalum mesh gauze was used in the wounds, and while this complication is being included under infections, it probably represented simply reaction to a foreign body.

DISRUPTION

We use the term *disruption* to mean a separation of the anterior fascial sheath and of the deep layers of the wound.

In this series (tables 1 and 2) factors of importance relative to wound disruption were the types of incisions used, the age, sex and color of the patient, hypoproteinemia, the presence of mechanical stress on the wound and infection of the wound.

Although twice as many lower abdominal vertical incisions were made than upper abdominal vertical incisions, seven of the eight disruptions (88 per cent) occurred in upper abdominal vertical wounds, one of the seven being in a combined upper and lower abdominal wound. All of these upper abdominal wounds complicated by disruption had been closed with continuous chromic catgut in the peritoneum and anterior rectus sheath and with silk for retention and skin sutures.

Eighty-seven of the upper abdominal incisions were closed with continuous chromic catgut in the peritoneum and anterior rectus sheath. Twenty-four were closed with interrupted silk sutures in the fascia and continuous chromic catgut in the peritoneum, 11 of the latter incisions having silk retention sutures in addition. It seems, therefore, that upper, vertical, abdominal incisions are much

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TABLE 1
Incisions and types of closure

	Laparotomies	Disruption	Partial Skin Separation	Infection	Hernia	Hematoma
Upper paramedian		4	1††	3	1	0
Absorbable sutures*	77					
Nonabsorbable sutures†	10					
Nonabsorbable sutures plus silk retention sutures	13		1			
Lower paramedian						
Absorbable sutures*	13	0	0	0	0	1
Nonabsorbable sutures†	0	0	0	0	0	
Nonabsorbable sutures plus silk retention sutures	1	0	0	0	0	0
Lower midline						
Absorbable sutures*	140	0	1	0	0	2
Nonabsorbable sutures†	93	0	0	0	0	0
Nonabsorbable sutures plus silk retention sutures	9	1	0	3‡	1	0
Upper midline						
Absorbable sutures*	10	2		1	0	1
Nonabsorbable sutures†	0	0		0	0	0
Nonabsorbable sutures plus silk retention sutures	1	0	0	0	0	0
Upper transverse						
Absorbable sutures*	1	0	0	0	0	0
Nonabsorbable sutures†	2	0	0	0	0	0
Nonabsorbable sutures plus silk retention sutures	2	0	0	2‡	0	0
Lower transverse						
Absorbable sutures*	0	0	0	0	0	0
Nonabsorbable sutures†	3	0	0	0	0	0
Nonabsorbable sutures plus silk retention sutures	0	0	0	0	0	0

	Nonabsorbable sutures plus silk retention sutures.....									
	0	0	0	0	0	0	0	0	0	0
Combined upper and lower paramedian	19	1	0	2	0	0	0	0	0	0
Nonabsorbable sutures†	3	0	0	0	0	0	0	0	0	0
Nonabsorbable sutures plus silk retention sutures.....	4	0	1	1§	0	0	0	0	0	0
McBurney incision	94	0	0	5	0	0	1††	1**		
Rocky Davis incision	5	0	0	0	0	0	0	0	0	0
Total.....	500	8	4	17	3.4%	0.8%	3	0.6%	5	
Percentage.....		1.6%							1.0	

* Continuous chronic catgut in peritoneum.

Continuous chronic catgut in fascia.

Silk or cotton in skin.

Silk or cotton retention sutures.

† Continuous chronic catgut in peritoneum.

‡ Interrupted silk or cotton in fascia and silk or cotton in the skin.

§ 1 had tantalum mesh sutured with silk.

§ Extrusion of silk sutures at intervals.

** Metastatic carcinoma to liver with prothrombin activity of 35 per cent.

†† Had bile drainage with maceration of skin.

‡‡ Gelfoam and delayed closure because of hemorrhage.

more subject to disruption than are lower abdominal, vertical, incisions. Five of the disruptions were in upper paramedian incisions and two were in upper midline incisions. If from so small a number one may draw an inference, since 2 out of the total of 10 upper midline incisions disrupted, it would seem that midline incisions in the upper abdomen are particularly vulnerable to disruption. In this series, the number of transverse incisions in the upper abdomen was too small to compare with the vertical incisions.

Of interest is a comparison of the use of absorbable and nonabsorbable sutures in the lower abdominal vertical incisions since the number of incisions of each type was roughly equal. In 140 such incisions, continuous chromic catgut was used in the peritoneum and fascia with interrupted silk in the skin and for retention sutures. In 102 incisions the peritoneum was closed with continuous chromic catgut, but the fascia was closed with interrupted cotton or silk. In this group no retention sutures were used except in 9 incisions. The one lower abdominal wound disruption occurred in an incision closed with interrupted silk sutures in the fascia and interrupted silk retention sutures. Apparently, in the lower abdomen, it does not matter whether absorbable or nonabsorbable sutures are used so far as disruption is concerned. The number of transverse incisions in the lower abdomen were too few to compare with the vertical incisions. No disruptions occurred when either the McBurney or the Rocky Davis incisions were used.

Wound disruption in patients more than 50 years of age had a much higher incidence of disruption than in younger people; the incidence being 5.7 per cent and 0.26 per cent respectively. This is a matter of importance for more and more people are living to advanced ages and are properly being submitted to major procedures. Likewise white patients had a higher incidence of disruption than negro patients, the incidence being 1.9 per cent and 0.6 per cent respectively. Disruption occurred in 6.3 per cent of males and 0.25 per cent of females. Probably the relative frequency of lower abdominal incisions in females may account for at least part of this ratio incidence.

In 4 of the 5 cases with wound disruption in which serum protein determinations were done, hypoproteinemia was found. This is suggestive, at least, that hypoproteinemia is a factor predisposing to disruption, and, indeed, we strongly believe this to be true.

Mechanical stress on the wound seemed to have a causal relationship to disruption in many cases and certainly was at times the precipitating factor in our series. Abdominal distention causes constant tension on the sutures with resultant ischemia of the tissues contained in the sutures. Aids in preventing and combating distention include the withholding of food and fluids orally until intestinal peristalsis has resumed postoperatively; the prevention of sodium chloride and potassium deficits; and the use of the Levine tube with suction when indicated. Coughing and vomiting increase intra-abdominal pressure suddenly and may cause an area of separation in the depths of the wound with progressive enlargement, if coughing and vomiting continue. Particularly is this true if an omental wedge enters into the separation.⁶ Of the 8 cases of disruption that oc-

curred in this series, excessive coughing was present in 4; tracheal aspiration near the end of anesthesia was done in 2; abdominal distention was present in 2; and excessive vomiting occurred in 3. It would seem helpful to treat cough preoperatively when present. The patient who smokes might well discontinue using tobacco during the preoperative period. Adequate support to the abdominal wall, if postoperative coughing should develop, gives comfort and perhaps some security. Aspiration of the trachea during the deeper stages of anesthesia rather than waiting until the cough reflex has been regained is wise. Excessive vomiting can be combated successfully with a Levine tube with suction.

Wound infection was the obvious cause of disruption in 3 of the 8 cases. There was a gradual breakdown of the infected wound until silk retention sutures alone were holding it together. In the third case, partial disruption in the area of the wound where a silk retention suture inadvertently had been passed through small bowel causing a localized peritonitis was noted at autopsy. In a fourth case, perforation of small bowel was present in the wound so that it is possible that a similar circumstance led to this disruption.

The symptoms and signs of disruption were: a serosanguineous drainage in 6 cases; sudden pain followed by a dull ache in the wound at the onset in 1 case; and a subjective feeling of separation in 1 case. When disruption occurred suddenly, the dressing usually promptly became wet with serosanguineous fluid and, at least in 1 case, the patient suspected that his wound had *come open*. It is thought that the onset of disruption at times occurred prior to the actual complete separation of the wound. Thus in 1 case the notes state that on the fourteenth postoperative day when the patient turned over in bed he had a sharp pain in the wound and that thereafter there was a dull ache in the wound. On the following day, shortly after the skin sutures were removed, the entire thickness of the abdominal wound separated. In another case, repaired soon after disruption occurred, the intestine was adherent to the walls of the wound beneath the skin as if this part of the wound had separated a few days previously.

Although in most cases the diagnosis of disruption was obvious, usually the edge of the dressing was raised to confirm the suspicion; the dressing was replaced promptly and reinforced with tape; and the patient was taken to the operating room for repair under aseptic conditions. Alternate silk and wire, through and through, closely spaced, sutures were used satisfactorily for closure in 1 patient. In another patient through and through, tantalum wire sutures only were used and on the following day it was found that the wires had broken in the upper half of the wound. Alternate silk and wire through and through sutures then were used followed by healing. Layer closure with chromic catgut, with frequent silk retention sutures and interrupted silk sutures in the skin was used satisfactorily in 3 patients. Always the tissues were friable and the layers not distinct. One case of partial disruption was treated nonoperatively by strapping the abdomen. Forty-five days were required for *healing* of the wound and the patient subsequently had an incisional hernia. In the remaining 2 patients the skin remained intact but wound disruption was demonstrated at autopsy.

The fact that half of the patients having disruptions died before leaving the

hospital is somber proof of the seriousness of this complication, though actually the disruption per se was directly responsible for death in only 1 of the 8 patients.

INFECTION

A second wound complication, infection, occurred in 17 patients, an incidence of 3.4 per cent. It seemed impossible, by review of these patients' charts, to accurately distinguish between *wound suppuration* and *wound infection* as defined by Lyons.² Consequently every wound draining any purulent material was counted in this series as a *wound infection*. Drainage of pus from an intra-abdominal abscess (present at surgery) was not considered a *wound infection*.

Five of the 17 wound infections (29 per cent) occurred following appendectomies. In this group of appendices, three were classed as acute suppurative appendicitis, one of which ruptured while being removed; one as gangrenous appendicitis; and one as acute catarrhal appendicitis. Because of the high incidence of wound infection in the severe cases of appendicitis, it seems that during operation, in addition to the usual protection of the wound edges with laparotomy pads and the exercise of care to prevent the appendix from touching the wound, it might be beneficial to irrigate the wound thoroughly with saline solution after the peritoneum has been closed just as is done when there has been gross contamination of a wound. According to Parsons⁴ such wounds should be closed with interrupted absorbable sutures in the fascia; interrupted silk sutures in the skin, and interrupted retention sutures of silk; and drained with small split Penrose drains placed down to the fascia.

In 8 (47 per cent) of the 17 cases of wound infection, gross contamination occurred at operation. In an additional 4 (23 per cent) of the cases, the operations were upon the stomach or small intestine in 3 cases and upon the colon in 1 case. Diabetes was present in 11.7 per cent of the cases of wound infection.

In all 5 cases of wound infection in which the serum proteins were determined, hyproproteinemia was present. Since this determination was not made in a majority of the cases, no definite inference is permissible. However, wound edema with impairment of circulation would tend to predispose to infection.

At and beyond middle age, wound infection, as would be expected, is more likely to occur. In the group of patients here reported 7.04 per cent of persons 50 or more years of age had infection, whereas only 2.1 per cent of those under 50 years of age had wound infection.

Because of the high incidence, in this series, of draining sinuses following the use of silk to suture tantalum mesh gauze in place, only tantalum wire is now used, or will be used, in the future in accordance with the recommendation of Koontz.¹ Tantalum mesh was used in the wounds of 5 patients. In 4 of these patients silk sutures were used, and in 2 of these chronic draining sinuses occurred, beginning on the tenth and sixteenth postoperative days and lasting until removal of the silk and tantalum at the end of 7 months and 10 months. In the 1 patient in whom tantalum wire was used and in 2 of the patients in whom silk was used, no complications developed. Although both the tantalum

and silk were removed in the patients with draining sinuses, it is probably true that removal of only the silk sutures would have been curative. In the remaining patient the chronic draining sinus seemed to be due to a mild infection in the wound closed with silk. The sinus lasted from the third postoperative week until healing finally occurred at the fourth postoperative month. Silk sutures were extruded through the sinus during this interval.

Details of importance in prevention of wound infections are rigid asepsis, (which includes the proper protection of the wound edges); the proper handling and disposal of contaminated instruments and drapes during operations upon the bowel; adequate preoperative bowel preparation in bowel surgery; irrigation and, on occasion, drainage of grossly contaminated wounds; and adherence to the careful handling of tissues as emphasized by Mont Reid,⁵ and others. A proper technic is most important insofar as postoperative wound complications are concerned.

A satisfactory method of management of abdominal wound infections, based on this series, seems to be removal of two or three sutures to allow drainage; the prompt starting of antibiotics with change to the antibiotic of choice when the sensitivity tests have been reported; irrigation of the wound with fresh Dakin's solution about twice daily; and attention to the general condition of the patient. Dilute acetic acid compresses and irrigations are helpful in eliminating the green pus of pyocyanous contamination in wounds.

Three of the 17 patients having wound infection died. One of these patients also had wound disruption, this being the only case in which the wound infection *per se* was directly responsible for death.

Although not encountered in this series of cases, progressive, postoperative bacterial synergistic gangrene as described by Meleney³ seems worthy of a brief description. This condition, according to Meleney, occurs occasionally after drainage of a deep abscess in the peritoneal cavity or chest and is due to the gangrenous action of the combination of the microaerophilic, nonhemolytic, streptococcus and a hemolytic staphylococcus aureus. Typically, according to Meleney, the wound becomes red, swollen and tender. "A few days later, the wound margins or the stitch holes develop a carbunculoid, indurated appearance. The center becomes purplish while the periphery becomes bright red, the whole area being extremely tender. Later the purplish area becomes gangrenous and the process advances slowly in all directions." Meleney's treatment for this condition at the present time is systemic bacitracin, 10,000 to 20,000 units intramuscularly every six hours, with the local application of bacitracin in ointment or as wet dressings in a concentration of 500 units per gm. or cc. one to four times daily.

SKIN SEPARATION

The third wound complication, a minor one, was skin separation in a part of the wound. This occurred in 0.9 per cent of the patients studied. Maceration of the wound by bile drainage was clearly the cause in 1 case. Hypoproteinemia was present in all 3 of the 4 patients on whom serum protein determinations were

made. Only 1 of the patients had a secondary closure but in 1 of the patients, treated by strapping the wound edges together, three weeks elapsed before complete recovery ensued.

HEMATOMA

A fourth wound complication was hematoma which occurred in 1 per cent of the cases and was always of minor significance. Nothing definite can be determined from a review of the records relative to its etiology. It is of interest that in this series, 27 of the patients received anticoagulants systemically and in none of these patients did hematoma occur. Evacuation of the hematomas encountered in this series of patients was followed by prompt healing of the wounds.

HERNIA—POSTOPERATIVE

According to the data on the charts, the incidence of the fifth and final wound complication, incisional hernia, was 0.6 per cent. However, the inaccuracy of such a study regarding this complication is obvious. One of the cases followed partial wound disruption treated by strapping of the wound, wound infection having been the cause of the partial disruption. Another case was subsequent to wound infection without a diagnosable wound disruption. The remaining case occurred in a McBurney incision wound in which hemorrhage from the depths of an abscess cavity resulting from rupture of the appendix was controlled by gelfoam held in place by packing which was brought out through the wound. It seems that the factors leading to incisional hernia would be essentially the same as those leading to wound disruption.

CONCLUSIONS

The incidence of wound complications in the 500 consecutive laparotomies now being reported was as follows: wound disruption in 1.6 per cent, wound infection in 3.4 per cent, incisional hernia in 0.6 per cent, hematoma in 1 per cent, and partial skin separation in .8 per cent. Chronic draining sinuses occurred in certain patients in which tantalum gauze was sutured in place with silk sutures and in 1 patient closed with silk sutures and having mild infection with extrusion of silk sutures through a sinus for three and one-half months.

There was a relatively high incidence of disruption in patients having upper abdominal vertical incisions; in patients more than 50 year of age; in white patients; in male patients; in patients having mechanical stress on the wounds; and in patients having wound infections. In addition the data suggested, and we believe, that hypoproteinemia is a factor in wound disruption. The most common sign of wound disruption was rather profuse, serous or serosanguineous drainage. At times, the onset of disruption was hours or days previous to the completion of the disruption. When disruption occurs we have almost always done an immediate repair. The mortality rate in the cases of disruption was 50 per cent.

A relatively high incidence of wound infection occurred in patients having gross contamination of the wound; in patients having acute suppurative or

gangrenous appendicitis; in patients having operations upon the bowel; and in patients more than 50 years of age. Eleven and seven-tenths per cent of infections occurred in diabetics. It was suggested that hypoproteinemia may be a predisposing factor in wound infection.

Obviously the same factors that predispose to wound disruption predispose to incisional hernia.

Hematoma and skin separation in a part of the wound were a relatively minor complication.

It should be helpful to know when, and under what circumstances, these various wound complications are most likely to occur. The prevention and management of wound complications involve attention to many details in preparing the patient for operation; in the handling of the tissues during operation and in the care of the patient postoperatively. Any wound complication is undesirable; all provoke discomfort and economic loss, and some are lethal. Not all, but some complications, can be prevented by sound surgical judgment and meticulous technic.

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SURGICAL TREATMENT OF PATENT DUCTUS ARTERIOSUS

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During the 16 years that have elapsed since John Strieder³ first operated upon a patient for patent ductus arteriosus, medical opinion has crystallized regarding the indications for surgery in this abnormality. Large numbers of patients have been operated upon—particularly by Gross⁴ and the excellent results of surgical treatment are well known. Operative technic, or the method used to obtain permanent obliteration of the ductus, has varied. The surgical method has not become standardized and we believe that this is as it should be.

INDICATIONS

Because the life span of individuals with a patent ductus arteriosus is shortened, and because normal growth and development may be impeded, surgical intervention is practically always advised. This attitude is justified by the low operative mortality rate which is less than 1 per cent when the procedure is done as a prophylactic measure and only slightly higher when done on individuals who present disability as a result of the lesion. The elimination of a psychogenic state of cardiac invalidism, based only upon the known presence of a murmur, may be sufficient justification for operation. Operation may be undertaken with the assurance that this is one form of heart disease that can be completely and positively cured.

Based upon an extensive experience with both complicated and uncomplicated cases of patent ductus, Scott⁵ has concluded that the risk to the patient imposed by the untreated patent ductus is considerably greater than the negligible risk of surgical closure.

OPERATIVE PROCEDURE

The large operative series of Gross in which the ductus is routinely divided between clamps, leaves little or no room for improvement in mortality statistics and results. However, we believe that the *suture-ligation technic* described by Blalock¹ is equally effective and that it is less dangerous in the hands of most surgeons.

The technic outlined by Conklin and Watkins,² utilizing the Potts-Smith-Gibson clamp for occlusion of the aortic terminus of the ductus, has appealed to us as the safest procedure in the hands of the occasional operator.

Most unmanageable operative hemorrhages have probably occurred during the dissection of a broad, thin-walled ductus, especially during dissection of its

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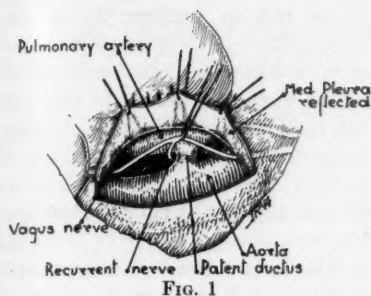


FIG. 1

FIG. 1. Relations of the exposed ductus

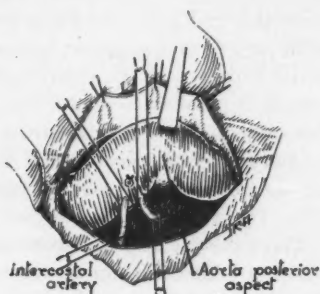


FIG. 2

FIG. 2. Mobilization of the aorta

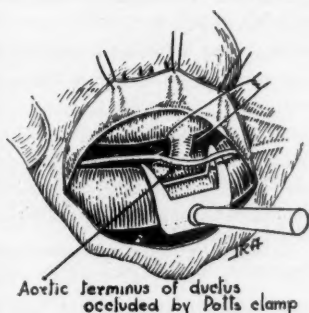


FIG. 3

FIG. 3. Application of clamp to aorta

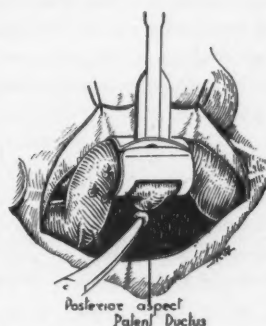


FIG. 4

FIG. 4. Elevation and rotation of aorta. Dissection of posterior aspect of ductus under direct vision.

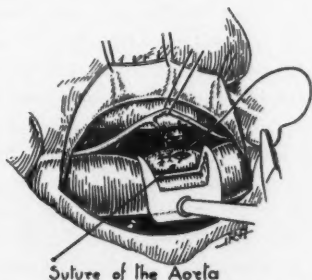


FIG. 5. Closure of aortic defect

posterior aspect. If bleeding should occur before the ductus has been adequately exposed, and with control of neither end accomplished, certainly a formidable hemorrhage, difficult or impossible to manage, might be expected.

We prefer to mobilize the aorta, expose the aortic terminus of the ductus and

occlude this end with the Potts clamp.⁶ Then with sure control of the major possible source of dangerous hemorrhage we are able to complete the circumferential exposure of the entire ductus with considerably more confidence and safety. It is possible to dissect the posterior surface of the ductus under direct vision. After complete exposure is obtained the ductus is ligated as near the pulmonary artery as possible and divided with the knife near the aorta. A transfixion suture is placed near the pulmonary artery to insure against slipping of the tie. The aortic opening is then closed with a continuous suture of arterial silk. The second cause of dangerous hemorrhage, slipping of clamps placed on the ductus, is likewise eliminated by this technic.

The long ductus of small caliber is not a difficult problem by any operative method. The broad, short ductus is a formidable surgical problem. It is particularly for the latter that one must seek out the safest method available and we have used the above described technic for these cases. We prefer to handle the ordinary ductus by the suture-ligation technic of Blalock.

Our small series of 16 patients operated upon has been without mortality and the only complication encountered has been one temporary recurrent laryngeal nerve palsy.

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PULMONARY COMPLICATIONS FOLLOWING UPPER ABDOMINAL SURGERY

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Surgeons, internists and anesthesiologists alike may take pride in the remarkable reduction in the incidence and mortality of postoperative pulmonary complications which has occurred in the past 10 to 15 years. On the other hand, there is no room at all for complacency in the present situation. These complications are still occurring. They still account for a significant percentage of postoperative morbidity and for a significant number of postoperative deaths. It is true that they are largely preventable, granted that correct prophylactic measures are instituted before and after operation. It is also true that when they occur they are, for the most part, controllable and curable, though we would do well to bear in mind that, because the most important of them are not primarily infectious processes, the antibiotic drugs which are so potent in other circumstances are somewhat less effective in their management. The chief fact that must give us pause is that notwithstanding what we have learned about postoperative pneumodynamics, we still have no exact knowledge as to what initiates atelectasis, which is by far the most frequent of all postoperative pulmonary complications and which is the process from which postoperative bronchopneumonia and lung abscess take their origin. It is for these reasons that I shall limit my remarks to atelectasis in this brief presentation.

INCIDENCE

The true incidence of pulmonary complications following surgery is difficult to determine. Many reports take account of only the most serious. The criteria upon which the diagnosis is made are not always clear, if indeed they are stated at all. The interpretation of physical findings frequently varies from observer to observer, as does the interpretation of roentgenograms, which, although they are essential for a complete diagnosis, are not always made. If the analysis is made from hospital records, the value of the statistics depends upon the accuracy of the original observers and the care with which progress notes were recorded. This type of analysis is, of course, by no means as reliable as studies made on patients in the course of their hospitalization. Not the least of the value of the report of Dripps and Deming⁶ from the University of Pennsylvania Hospital is the fact that it was made directly upon the patients and that it is sufficiently extensive (it covers 1,240 upper abdominal operations) to have statistical significance.

In this connection, the paradox might be mentioned that the more careful the

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observation of patients, and the more exacting the criteria of diagnosis, the higher is the reported incidence of pulmonary complications after operation. At the same time, because better care is always inherent in more careful observation, the morbidity is likely to be less, while the mortality is minimal or perhaps even zero.

With these qualifications and reservations, it may be said that the incidence of postoperative pulmonary complications averages perhaps 2.5 to 3 per cent in all operations; from 10 to 12 per cent in abdominal surgery, and from 20 to 30 per cent in upper abdominal surgery. Pooler,¹¹ for instance, in an analysis of 5,869 personally administered anesthetics, not including those given for thoracic surgery, reported an incidence of 0.7 per cent of pulmonary complications in operations outside of the abdomen; 10.9 per cent in operations upon the lower abdomen, and 19 per cent in operations upon the upper abdomen. Dripps and Deming's⁶ incidence of 5.5 per cent in the 1,240 upper abdominal procedures just referred to cannot be taken as typical for the reason that, during most of the period covered by the survey, a special endeavor was made to keep this type of complication at a minimum. In 648 partial gastrectomies which I recently studied from three New Orleans hospitals,⁸ the incidence of pulmonary complications after operation was 10.5 per cent. They were more numerous than any other complications (68 of 185), and they played some part, though I cannot fairly say the major part, in 17 of the 52 deaths in the series. This predominance is about what would be expected, since pulmonary complications are notably more frequent after operations upon the stomach.

Every reported series indicates that postoperative pulmonary complications are far more frequent in men than in women. The explanation is physiologic: Male respiration is diaphragmatic and abdominal, while female respiration is costal, which means that men are more likely to be disturbed by abdominal surgery, particularly upper abdominal surgery, than are women. A second reason for the male predominance of such complications is related to the first: Normal respiration is re-established more promptly after operation in women than it is in men.²

Similarly, there is no doubt that pulmonary complications increase in incidence as age advances, though the disparity is less striking than it once was. The elderly patient who once died of stasis pneumonia after operation is now moved about and ambulated so promptly that he seldom develops it. Atelectasis and its sequelae, however, remain a major hazard in this age group, and particular vigilance is required to prevent them. As my own statistics for gastrectomy show,⁸ older patients do not tolerate them as well as do younger patients. According to Dripps and Deming's⁶ statistics, maximal resistance to this type of postoperative complication occurs in the fourth decade.

ETIOLOGIC BACKGROUND OF ATELECTASIS

The pathologic alterations which occur in atelectasis are now quite well understood. Recent studies in pulmonary function, including pulmonary ventilation and pulmonary blood studies, have made it clear that the problem is far more

complex than it originally seemed to be. We know that atelectasis occurs because (1) secretions are retained in the bronchial tubes after operation, (2) the retained secretions are abnormally viscid; but we do not know why the secretions are retained or why their viscosity is altered. The most reasonable explanation now available is, as Drinker⁴ has postulated, abnormal blood stasis in the lungs. Maier,⁹ among others, has made an excellent case for the theory.

The structure of the lungs, Maier points out, is excellently adapted to blood storage, which can be accomplished without any increase in their external dimensions. The circumstances of operation favor the accumulation of blood within the lungs. As a result of the change from the upright to the recumbent position, blood is drained out of the dependent veins, while at the same time the muscular inactivity and depression of bodily function, inevitable during and after operation, lessen the demand for blood in large portions of the body which would otherwise require it. Lowering or actual loss of pressure in the pulmonary venous system makes the recumbent position significant in determining the distribution of blood in the lungs, since gravity has a much greater influence on the pulmonary than on the systemic circulation. Drinker and Hardenbergh's⁵ experiments showed that while animals were under sedation, as is the patient upon the operating table, the dependent, congested parts of the lung are poorly ventilated. Another argument in favor of this hypothesis, as Maier points out, is the well known fact that the high incidence of pulmonary complications after splenectomy, especially when it is done for splenomegaly, can reasonably be explained by the elimination of one blood reservoir, that is, the spleen, and the taking over of its storage function by another reservoir, that is, the lungs.

Blood stasis may or may not be the final explanation of the development of atelectasis following operation, but there is no longer any doubt about a number of other facts. Immediately after operation there is a decrease in the vital capacity.³ It is scarcely affected by operation upon the limbs, but it is reduced to about 50 per cent of its original value after operations upon the lower abdomen, and to as little as 25 to 30 per cent after operations upon the upper abdomen. There are a number of reasons for this phenomenon. One obvious explanation is the pain which is experienced with respiration after operation. Another is the general loss of tonus after anesthesia and surgery, which affects the muscles of respiration just as much as any of the other muscles of the body. Roentgenograms taken after operation provide visual proof of the decrease in the vital capacity. Almost invariably the diaphragm is shown moved upward from its normal position much farther than it ever moves under the deepest and most forcible voluntary expiration.

To state this chain of events in their simplest terms, the following changes occur after anesthesia and surgery: 1. The size of the thoracic cage is decreased. 2. Portions of the lungs are deflated. 3. The bronchi do not dilate widely. 4. The mucus which is ordinarily expelled from the bronchi as a continuous process is trapped in them. 5. A vicious cycle is set up in which a small accumulation of mucus leads to a larger one; changes in viscosity occur; the bronchi are occluded by these mucous masses; the trapped gases behind the masses are absorbed by

venous blood; and areas of de-aeration develop and progress. The end result is that respiration is chiefly carried on in the upper and anterior portion of the lungs and function more or less ceases in the other portions.

The process which has been described seldom subsides spontaneously. Instead, it tends to progress and extend. Once obstruction of the bronchi occurs, collapse of pulmonary tissue necessarily follows. Infection is the next step, manifested immediately by bronchopneumonia, or later, as a lung abscess. The embolic origin of pulmonary abscess is no longer accepted. All the evidence points to its infectious origin, either on the basis of a previous atelectasis which has not been controlled or on the basis of aspiration.

An acute pre-existing upper respiratory infection sometimes plays a role in postoperative pulmonary complications, but this is true only when emergency surgery must be done. A more important consideration is the pre-existence of other pulmonary diseases, such as tuberculosis, bronchiectasis, asthma, or a chronic cough of one origin or another. Still another possible and preventable cause of postoperative pulmonary complications is oral infection which has not been corrected before operation.

The conditions which have just been discussed are the basic causes of postoperative pulmonary complications. Other factors, however, must also be taken into consideration. The anesthetic agent itself is no longer regarded as of major importance, but the skill and competence with which the anesthesia is administered are vital. Dripps and Deming's records show this conclusively. In the first years of their study, major pulmonary complications were three times more frequent after inhalation anesthesia than after spinal. When a definite program was instituted for patients to be submitted to inhalation anesthesia, the differential promptly disappeared.

This is an era of long operations, which is natural, because there has been so great an increase in the magnitude of surgical procedures. At first thought, it might seem that the prolongation of anesthesia and operation would inevitably increase the incidence of postoperative pulmonary complications. This has not proved to be true. There should be no increase in risk, in fact, if the anesthetic is skillfully administered; if the plane of anesthesia is in keeping with the stage of operation and the requirements of patient and surgeon, and if anesthesia is discontinued as soon as the need for it ceases, which is usually as soon as the peritoneum is closed.

Dripps and Deming observed no increase in postoperative morbidity in relation to the duration of operation until after three hours had elapsed. This is reassuring, since even today relatively few operations on the upper abdomen last longer than three hours.

Another point, well on the way to being accepted as a generalization, is that transverse incisions are associated with a smaller incidence of pulmonary complications than are vertical incisions. The explanation again goes back to respiratory physiology. With a transverse incision, the respiratory excursion after operation is less painful, because there has been less injury to the intercostal nerves which supply the musculature of the upper abdominal wall, and the respiratory act is therefore more nearly normal. Thompson, MacLean and

Coller,¹³ in a study of 1,367 major abdominal operations, found the incidence of pulmonary complications consistently lower after transverse incisions, no matter what the type of surgery. One would scarcely be justified in asserting that the transverse incision should be universally substituted for the vertical incision, for it has its disadvantages and limitations, but certainly the surgeon, in deciding to use the one or the other, might bear in mind the smaller incidence of pulmonary complications associated with the transverse incision and might use it, other things being equal, in patients who are candidates for such complications, including elderly men and short, obese patients.

Certain causes which once influenced postoperative pulmonary complications are no longer very important in these days of intensive postoperative care. Gastric dilatation, for instance, almost never occurs today because gastrointestinal decompression is used routinely, whenever gastric or gastrointestinal distention is a possibility, or is instituted promptly if the difficulty should arise unexpectedly. Tight binders, which once were the rule and which obviously hinder free respiration, are now used only when a definite indication for them exists, which is not very often.

CLINICAL CONSIDERATIONS

The clinical manifestations of atelectasis depend upon the extent and severity of the pathologic process. Early physical signs are notably few. The most important diagnostic evidence is an unexplained and usually abrupt elevation in temperature, pulse rate and respirations. Cyanosis, diminished breath sounds, coarse, bubbling rales and sticky wheezes leave no doubt of the diagnosis, but they are late signs, not early ones.

Diagnosis in the early stages of atelectasis is therefore a matter of constant observation, with prompt resort to roentgenologic examination once there is an unexplained change in the vital signs. As a matter of fact, routine roentgenograms after operation would reveal that some degree of atelectasis exists in an astonishingly large number of patients. Stringer,¹² who made roentgenologic studies of 55 patients submitted to partial gastrectomy, found five instances of atelectasis within four hours after operation, and six others within 24 hours, in contrast to only two instances detected after this length of time. His studies simply furnish graphic proof of the general clinical experience.

Atelectasis may occur upon the operating table. It is most usual within 24 hours of operation and it almost never occurs after the 48 hour period. This is in contrast to postoperative bronchopneumonia, which manifests itself on the third or fourth postoperative day by a less abrupt rise in the temperature, pulse and respiration. It is in even sharper contrast to lung abscess, which occurs weeks or even months after operation. The differential diagnosis is thus possible on the time element alone.

PROPHYLAXIS AND THERAPY

The clue to the control of atelectasis is the maintenance of a good cough reflex to prevent the retention of secretions, and the prompt institution of therapy when the cough reflex ceases to be effective. The use of measures to control

coughing after operation is strictly contraindicated. It is not too much to say that the more the patient can be made to cough in the early postoperative hours, the less is the chance of his developing atelectasis.

Any evidence at all of the development of atelectasis must be acted upon promptly. Even the patchy variety, with inconclusive roentgenographic findings, cannot be trifled with or watched. Atelectasis constitutes an emergency and requires emergency treatment, without any delay. If the involvement is not extensive, vigorous pounding over the affected area may loosen the obstructing plug and permit aeration of the occluded bronchus. If this simple measure is not immediately effective, there should be no delay in the institution of more radical therapy. The method of catheter suction devised by Haight and Ransom⁷ has been a most useful addition to the postoperative routine. It is a simple procedure, which can be carried out in less than five minutes by a physician who is accustomed to using it. If necessary, the catheter can be left in situ after it is introduced and suction repeated as necessary. Oxygen therapy, if it is indicated, can be given simultaneously through a nasopharyngeal catheter. The introduction of the catheter, however, is not a pleasant experience for the patient, and if he is seriously ill, or if difficulties are encountered, Haight and Ransom suggest that it is less disturbing and more effective to resort promptly to bronchoscopy. Ochsner¹⁰ has made the further suggestion that if the patient is comatose, or if it seems that bronchoscopy is likely to be necessary more than once, it is simpler to do a tracheostomy without delay and continued suction through it as long as indications for it exist.

While drainage is the cornerstone of the treatment of atelectasis, even in its early stages, there are other measures which should be used as adjuncts, including, of course, a full course of antibiotic therapy. Most authorities do not view with much favor the use of drugs to promote bronchorrhea after operation, but it is a theoretically sound method, and one which should be more widely used. Baker, Roettig and Curtis,¹ who used sodium iodide intravenously for this purpose, found it to be a specific therapeutic agent to control bronchial secretory physiology, its effect being to increase the fluid volume of secretions by lowering their viscosity. Not 1 of the more than 100 patients in whom they used this plan prophylactically developed either atelectasis or pneumonia after operation, and the method was equally effective when it was used to control atelectasis which had already developed.

Sedatives and narcotics should be used sparingly and should be given only on the basis of individual needs. Before operation some one of the shorter-acting drugs, such as seconal, is preferable to a drug with a longer action, such as nembutal. Morphine, which suppresses ciliary activity and thus fosters retention of secretions, should be used as infrequently as possible and in as small doses as possible. Many patients do just as well with codeine as with morphine, and some need no drugs at all for the relief of pain.

Deep breathing is almost as important as coughing, and can be encouraged, notwithstanding the discomfort which it may cause, by the correct approach to the patient. Manual splinting of the wound is useful. Some authorities have advocated the use of an intravenous drip of procaine, which avoids the pro-

nounced drop in the vital capacity and in pulmonary ventilation caused by narcotics and sedatives, and others have recommended intercostal nerve block. Most observers do not think the routine use of either of these methods is justified.

The position of the patient has much to do with the prevention of atelectasis. Upon the operating table a slight Trendelenburg position, if there is no contra-indication to its use, is always preferable to a position of horizontal recumbency. The surgeon is seldom inconvenienced if the head and chest are slightly lower than the body. This position favors the gravity flow of bronchial secretions and also tends to prevent their aspiration and the aspiration of vomitus.

The day has long since passed when the patient, after operation, is permitted to lie in any one position for any length of time. If he cannot turn himself, he is turned, and he is *ambulated* as promptly as possible. Some positions are more desirable than others. If he lies flat on his back, large numbers of bronchi directly posterior tend to receive and retain secretions, while there is stasis of blood in parts of the lung below the level of the pulmonary veins. Haight and Ransom⁷ suggest that the foot of the bed be raised routinely after operation. They also recommend that the lateral position should not be permitted for more than 20 to 30 minutes at a time, since in this position secretions from the uppermost lung gravitate into the dependent lung. As a matter of fact, the optimal position after operation is prone, with the foot of the bed elevated, and if once the patient can be persuaded to assume this position, he will probably not find it too uncomfortable or otherwise undesirable.

Other methods of prophylaxis are so well known that it seems almost unnecessary to rehearse them. On the other hand, they are so important that, elementary though they may seem, they are well worth repeating. Two precautions, for instance, are necessary in the patient who is to undergo elective surgery after an upper respiratory infection, even if it is no more than a simple cold. The first is that operation must be delayed, at a minimum, for 10 to 14 days. Clinically the patient may seem perfectly well, but recovery from even a simple respiratory infection does not occur in two or three days. The second precaution is that he must have a careful chest examination, preferably supplemented by a roentgenogram. The same precautions are necessary in all patients with asthma, chronic cough or other respiratory difficulties, and in all heavy smokers. Dripps and Deming suggest that all patients, even those who present no obvious abnormalities, should be specifically questioned as to morning secretions and that those who suffer from them, as well as all smokers, should be booked late in the operating schedule, after their air passages have been thoroughly cleared. The stage is set for trouble in such patients, and special care must be taken to prevent it. It is a wise plan to call the anesthesiologist into special consultation in such cases and to follow his advice as to the anesthetic agent.

Cleaning the teeth and keeping the mouth clean are usually taken for granted today, at least in private patients, but probably should not be, for carelessness in this respect appears in the most unexpected quarters.

Dripps and Deming found in their study of postoperative pulmonary complications that the incidence was rather less in private than in ward patients.

Others have made similar observations. The temptation, at first, is to explain the discrepancy on the ground of the better nutritional state of more privileged patients, but the more reasonable explanation, as Dripps and Deming found, is the better nursing care which special nurses give private patients. Out of this discovery grew their decision to put the whole matter of postoperative pulmonary complications up to the nursing staff, as a challenge. Their venture paid large rewards, as might, indeed, have been expected, for most of the measures suggested for the prevention of postoperative pulmonary complications, like much of the therapy required when they develop, take their origin in good nursing care.

SUMMARY

Atelectasis, the most frequent and most important of all postoperative pulmonary complications, is a progressive process, which may be followed by pneumonitis, bronchopneumonia and lung abscess if it is not checked promptly. The pathologic process is now fairly well understood, but there is still no entirely satisfactory explanation for the retention of bronchial secretions after operation and their increased viscosity. Stagnation of blood in the lungs is the most reasonable explanation now available.

The cornerstone of prophylaxis in atelectasis is the maintenance of a good cough reflex after operation. Once the process develops, no matter how slight it may be, active therapy must be instituted without delay, with catheter suction, bronchoscopy or tracheostomy resorted to as necessary to maintain free bronchial drainage. A useful adjunct measure is the intravenous use of sodium iodide, which has been shown to promote bronchorrhea and reduce the viscosity of the bronchial secretions.

Many of the prophylactic and therapeutic measures used in postoperative pulmonary complications are based upon good nursing care, and the nursing staff is likely to respond to the challenge when it is properly presented to it.

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SURGICAL THERAPY FOR PULMONARY COCCIDIOIDOMYCOSIS

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Pulmonary coccidioidomycosis, a fungus disease which occurs as a result of the aspiration of the chlamydospores of *Coccidioides immitis*, is endemic in the San Joaquin Valley area of California, and in Arizona, New Mexico and western Texas. Because so many men in the Armed Services were stationed in these endemic areas during the Second World War, infected persons are now seen in substantial numbers in all parts of the country. Pulmonary coccidioidomycosis manifests itself in two forms: a primary benign form in which the infected person may show no symptoms or only those symptoms of a mild upper respiratory infection, and in which recovery is invariable; and a secondary, disseminated, so-called *granulomatous* form in which the mortality rate is approximately 50 per cent.

In Trimble's⁶ excellent review of coccidioidomycosis, he states that the incidence of pulmonary cavity formation in Army hospitalized patients ranged from 2 to 8 per cent. Most of the cavities that develop close spontaneously during a period of several months of observation. However, in Winn's⁸ review of 13 patients with coccidioidal pulmonary cavitation, 3 patients had cavities which remained open for two years or longer, and in 1 of these 3, the cavity closed spontaneously at the end of five and one-half years after artificial pneumothorax and closed pneumonolysis had failed to effect cavity closure.

The problem of therapy for a persistent coccidioidal pulmonary cavity is interesting. Since coccidioidomycosis is presently not considered contagious, and since many cavities persist for considerable periods of time without causing severe disability, many medical men believe that these cavities should not be treated energetically. However, patients with coccidioidal pulmonary cavitation frequently present themselves with a history of recurrent hemoptysis and/or persistent chest pain, and occasionally they present themselves with secondarily infected cavities or secondary pyogenic lung abscesses. For these patients simple medical treatment is not sufficient, and surgeons are becoming more convinced that these residual cavities should be resected.

When Moore, Murphy and Ward⁵ reported 2 cases in which both patients were treated by lobectomy for pulmonary coccidioidomycosis in 1949, they knew of only 2 other patients who had been treated by pulmonary resection for residual coccidioidomycosis. Since then several papers have appeared reporting the use of surgery in pulmonary coccidioidomycosis,^{1-4, 7} but the number of recorded cases in which the patients were treated surgically is still considerably less than 100. For this reason—and because the question of surgery in these patients is still in dispute—it is believed that the following 3 case reports are of interest.

CASE REPORTS

Case 1. I. J. B., a 29 year old white man was admitted to Lawson Veterans Administration Hospital on Nov. 10, 1949. He had been well until about two years before admission when he suffered his first attack of hemoptysis. This occurred in association with a cold, and consisted in the production of blood streaked sputum for several days. During the next year and a half he suffered several similar episodes, and between these attacks he had a persistent cough which mostly bothered him in the mornings, and which was accompanied by the production of small quantities of yellowish sputum. About three months before admission to the hospital the patient's cough became more troublesome, and he began to produce blood streaked sputum as often as three times weekly. After suffering a frank hemoptysis in which he lost about $\frac{1}{4}$ cupful of bright red blood, he was admitted to the Dublin Veterans Administration Hospital on Oct. 18, 1949. There a chest roentgenogram showed a cavity in the left lower lobe, and on November 10 the patient was transferred to Lawson Veterans Ad-

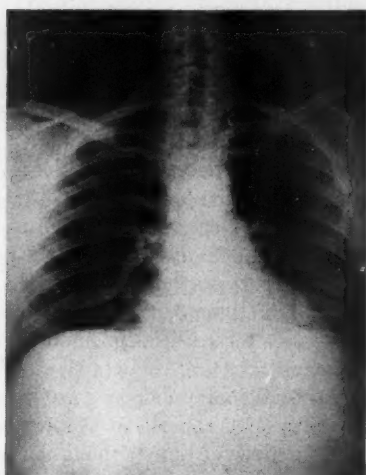


FIG. 1

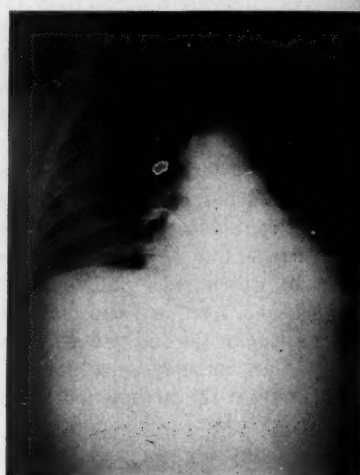


FIG. 2

FIG. 1. Case 1. A cavity is shown in the upper portion of the left lower lobe

FIG. 2. Case 1. Appearance of chest nearly two years following lobectomy of the left lower lobe.

ministration Hospital for further care. His past history was significant in that he was in the Army during the years from 1941 to 1945, and during this time he was stationed in Texas and in California. While in California he had an episode of fever accompanied by sore throat, and these symptoms were interpreted as being due to acute tonsillitis.

Admission chest roentgenogram showed a cavity in the superior division of the left lower lobe (fig. 1). Three 24 hour sputum specimens by smear and culture were negative for acid fast bacilli. Bronchial washings by culture and guinea pig inoculation were negative for acid fast bacilli and for pathogenic fungi. Skin tests with tuberculin and with coccidioidin were both positive. A specimen of serum was sent to Doctor Charles E. Smith. The complement fixation for coccidioidin was found by him to be 4 plus positive in a dilution of 1 to 2.

Because of the persistent cavity and the recurrent hemoptysis, which arose from his left lower chest, operation was advised and accepted. A left lower lobectomy was done on Feb. 6, 1950. Recovery was uneventful, and the patient was discharged from the hospital on February 24. The resected specimen was diagnosed by the Pathology Department as pulmonary

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coccidioidomycosis. An attempt to culture the organism from the resected specimen was unsuccessful.

This patient has been seen several times since his discharge, the last time being on Jan. 2, 1952 (fig. 2), nearly two years following his surgery. He had been asymptomatic since operation.

Case 2. T. G. P., Jr., a 31 year old white man was admitted to the Lawson Veterans Administration Hospital on Sept. 20, 1950. Three weeks before admission he had had a chest roentgenogram in reference to being recalled into the Army, and he had been rejected because of roentgenographic findings. He then went to a chest specialist who made a presumptive diagnosis of active pulmonary tuberculosis and recommended hospitalization.



FIG. 3



FIG. 4

FIG. 3. Case 2. Roentgenogram of chest showing a small cavity in the upper lobe of the right lung.

FIG. 4. Case 2. Roentgenogram of chest about 20 months after thoracoplasty

Review of this patient's past history revealed that he was well until 1944, when, while in the Army in service in Arizona, he began to have mild attacks of bronchial asthma, and severe headaches which he was told were due to allergic reaction. About 10 months before admission he developed a productive cough, which persisted until admission to the hospital. A chest roentgenogram at that time was said to be negative. There was no history of hemoptysis.

Admission chest roentgenographic studies showed a cavitary lesion in the right upper lobe (fig. 3). Tuberculin and coccidioidin* skin tests were both positive. Six sputum specimens on smear and culture were negative for acid fast bacilli, and one specimen of bronchial washings on culture and guinea pig inoculation was negative for acid fast bacilli and for pathogenic fungi. Because of the negative sputum examinations, a specimen of serum was sent to Doctor Charles E. Smith for complement fixation for coccidioidin, which was reported by him to be negative.

After three months of bed rest this patient's lesion was unchanged. Although coccidioidin

* Coccidioidin for diagnostic skin testing is now available commercially from Cutter Laboratories, Berkeley 10, California.

domycosis was believed to be the most likely diagnosis, it was thought that tuberculosis could not be entirely ruled out. Accordingly the patient was advised to subject himself to thoracotomy. He agreed, and right upper lobectomy was done on Jan. 15, 1951. The patient made an uneventful recovery except that an ineffective cough necessitated two bronchoscopies postoperatively. He was discharged from the hospital on February 6. Examination of the resected right upper lobe by the Pathology Department confirmed the diagnosis of coccidioidomycosis, and culture of a smear taken from the specimen resulted in the recovery of *Coccidioides immitis*.

The patient was readmitted to the hospital on March 7, and a partial thoracoplasty was done on March 21 in order to prevent over-expansion of the remaining right middle and lower lobes. He recovered from this operation without difficulty and was discharged on April 4, 1951. He has been seen at intervals since then, the last time being on Dec. 29, 1952 (fig. 4). He was asymptomatic at that time.

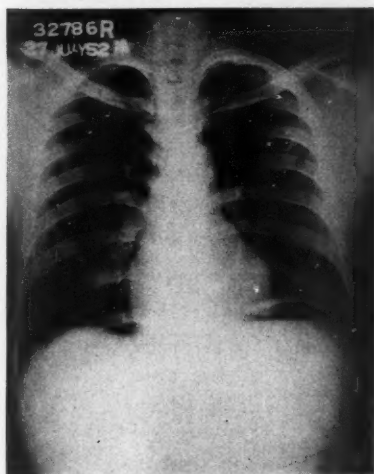


FIG. 5

FIG. 5. Case 3. Roentgenogram showing a cavity in the apical posterior segment of the left upper lobe.

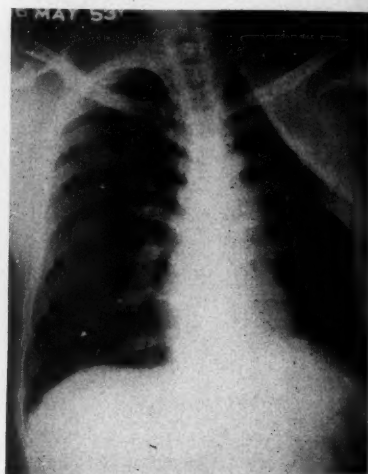


FIG. 6

FIG. 6. Case 3. Roentgenogram of chest about nine months after thoracoplasty

Case 3. E. L. S., a 31 year old Negro man was admitted to the Lawson Veterans Administration Hospital on June 6, 1952. During the month prior to admission he had had a mild unproductive cough. During the week prior to admission he suffered from constant dull aching epigastric and bilateral subcostal pain unaccompanied by nausea or vomiting. There was no history of hemoptysis. Review of the patient's past history revealed that while in the Army in 1943, he had spent 13 weeks in Arizona. However, during that period he had not been ill.

Admission chest roentgenogram showed the presence of a cavity 1 cm. in size in the apical posterior segment of the left upper lobe (fig. 5). Skin tests with coccidioidin and tuberculin were both markedly positive. Four sputum specimens and one specimen of bronchial washings by smear and culture were negative for acid fast bacilli. Complement fixation for coccidioidomycosis done in our own laboratory was negative.

A definitive diagnosis had not been established. The patient was advised to have an exploratory thoracotomy done. He agreed, and a segmental resection of the apical posterior

and anterior segments of the left upper lobe was done on July 9. Examination of the resected specimen established the diagnosis of coccidioidomycosis. In this specimen, the only one of the three, mycelial as well as endosporulating forms were seen. Recovery from lobectomy was uneventful, and on September 9 a partial left thoracoplasty was done. Again recovery was uneventful, and the patient was discharged on Sept. 30, 1952. He was seen again on May 16, 1953 (fig. 6) and at that time he was asymptomatic.

DISCUSSION

The first patient was operated upon because of persistent hemoptysis. The second and third patients were operated upon because coccidioidomycosis was suspected and it was believed that operation was required in order to establish definitive diagnosis and at the same time remove the pathology. In the past many patients with coccidioidomycosis have spent long periods of time under treatment in sanatoriums because tuberculosis could not be ruled out.

Cotton and Birsner,¹ in their excellent study of the surgical therapy for pulmonary coccidioidomycosis give the following indications for operation:

1. Specific types of cavities.
 - (a) giant cavity
 - (b) secondarily infected cavity
 - (c) blocked cavity
2. Rupture of cavity.
 - (a) spontaneous pneumothorax
 - (b) empyema
3. Nonexpansile lung.
4. Hemoptysis.
 - (a) continued
 - (b) severe
5. Coccidioma-expanding lesion.
6. Failure of medical treatment.

To these indications should be added that of a questionable diagnosis.

A patient who has a cavitory pulmonary lesion plus a positive coccidioidin test does not necessarily suffer from pulmonary coccidioidomycosis. Unless the causative organism can be recovered from the sputum or bronchial washings, the diagnosis of pulmonary coccidioidomycosis must remain in some doubt. In none of our cases could *Coccidioides immitis* be recovered from the sputum or bronchial washings.

It will be noted that in the patient who had a right upper lobectomy and the patient who had a segmental resection of the left upper lobe, subsequent partial thoracoplasties were done. Of the 30 cases reported by Cotton and Birsner,¹ 4 were complicated by tuberculosis. Of the 13 cases reported by Greer, Forsee and Mahon,² 1 patient developed pulmonary tuberculosis in the right lower lobe following resection of the right upper lobe, and 1 patient developed coccidioid cavity in the left lower lobe following resection of the left upper lobe. Jores and Bushueff,⁴ report reactivation in a case of presumably healed, nodular residuals of coccidioidomycosis. Because of these experiences, we believe that

when an upper lobectomy is done for coccidioidomycosis, a complementary or supplementary partial thoracoplasty should be done in order to prevent over-distention of the remaining lower lobe with consequent susceptibility to progressive disease.

Of the 3 cases herein reported all 3 patients were operated upon for pulmonary cavitation. In the series reported by Cotton and Birsner¹ six operations were done for empyema, and one operation was done because of rapid destruction of pulmonary parenchyma under medical management. In none of these patients was there spread of the disease.

CONCLUSIONS

Three cases are reported and all 3 patients had pulmonary resection for coccidioidomycosis.

The indications for operation as outlined by Cotton and Birsner are reiterated.

It is suggested that thoracoplasty should follow upper lobectomy for coccidioidomycosis.

It is indicated that pulmonary resection for coccidioidomycosis does not entail fear of dissemination of the disease.

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SURGICAL TREATMENT OF DEGENERATIVE ARTHRITIS OF THE HIP

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The term *degenerative arthritis of the hip* is used to designate abnormal changes in the joint which may be described as softening, fibrillation, necrosis and frictional erosion of the articular cartilage, especially over the weight bearing surface of the joint with sclerosis and surface necrosis of the underlying bone. Simultaneously with the wearing away of the articular cartilage from the weight bearing surface of the joint, there is proliferation of the cartilage and the subchondral bone around the margins of the joint with the production of osteophytes which tend to project outward and form a collar of new bone and cartilage about the head and neck of the femur. With this combined degeneration and hypertrophy of bone there is a moderate inflammatory reaction in the synovial membrane with some proliferation and round cell infiltration, as well as increase in vascularity. In some instances there is moderate effusion into the joint and the capsule may be thickened, but more often the capsule is thin and applied very tightly around the usually hypertrophied head of the femur without joint effusion. It is common to find subchondral cysts both in the head of the femur and in the adjacent acetabulum. At times these cysts seem to be empty and at other times filled with a mucoid material. Loose bodies are frequent.

These degenerative changes may occur in a previously normal joint. When this occurs we speak of it as a primary type of degenerative arthritis of the hip, the etiology of which is unknown. Although it is more often a disease of the aged, it may occur in younger people. It is possible that endocrine imbalance, chronic systemic infection, repeated minor trauma, or congenital weakness of the articular cartilage may be factors, but these lack proof. The condition may affect a single hip or be part of widespread degenerative disease involving both hips, the spine and other joints.

Pathologic changes as described may be expected to occur secondary to any condition that produces incongruity or damage of the joint surfaces, such as Legg-Perthes' disease, congenital subluxation, congenital coxa vara, infection, rheumatoid arthritis, slipped capital epiphysis, fracture of the neck of the femur and aseptic necrosis. The history, physical examination and roentgenologic studies will usually establish the nature of the primary condition and the resulting degenerative changes may then be spoken of as a secondary type of degenerative arthritis of the hip. This type, although it may occur in the aged following trauma, is more common in young people as the incongruity of the joint usually results from childhood conditions.

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These various changes may be of short duration or slowly develop over a long period of time, resulting in an altered gait, increasing stiffness of the hip, deformity and pain and a varying degree of disability in the patient. The degree of stiffness or the amount of pain of which the patient complains is not well correlated with either the physical examination or the roentgenologic picture, as some patients who complain of a great deal of pain may have but minimal findings both on physical and roentgenologic examination, while on the other hand marked destruction of the joint as seen on roentgenogram together with almost complete loss of motion of the hip may be relatively painless. Altered gait, stiffness or deformity are seldom the patient's chief complaints. Pain, however, is the most constant complaint and the one that usually causes the patient to seek relief.

We see then that degenerative arthritis of the hip is a condition resulting from many causes and occurring throughout adult life. Regardless of the causes or age of development, the pathology is essentially the same and the clinical picture is altered only by the extent of involvement and the degree of disability.

Therapy, whether conservative or surgical, has as its goal relief of pain and improved function of the joint. Conservative management must be thoroughly explored before considering surgical treatment. In our hands the number of different types of operations, as well as the over-all number of surgically treated patients, has steadily decreased as conservative measures have improved and new methods have been added.

Failures continue to occur. Perhaps one reason for failure is that it is often difficult or impossible to get a drug such as Compound F. into the hip joint. In others, the changes are so profound or the physical requirements of the individual so great that a more radical effort must be made to rehabilitate the patient. The surgeon has at his disposal a large number of difficult surgical procedures which have been described and recommended for the treatment of degenerative hip disease. Many of these have given good results in some cases but none is entirely satisfactory. It is true that improved surgical techniques, improved surgical materials, better understanding of the physiology of anesthesia and fluid replacement have removed many of the hazards of hip joint surgery. The elderly patient, however, does not too well tolerate prolonged and extensive hip surgery and does not tolerate prolonged postoperative fixation. Nor do these patients seem to have the stamina for the long periods of postoperative exercise and rehabilitation required to obtain good results following some procedures. Since many of these patients are elderly it is of the utmost importance that each patient, to be considered for surgery, have a careful preoperative survey, not only his physical and emotional condition but also his other requirements, both financial and social, and every effort made to fit the surgical procedure to the patient on an individual basis.

The operative procedures most commonly used by us are: (1) neurectomy, (2) capsulotomy, (3) acetabuloplasty, (4) osteotomy, (5) arthrodesis and (6) arthroplasty. Each of these will be briefly discussed.

Neurectomy. The operation of obturator neurectomy is one of the simplest

surgical procedures for the relief of pain in the degenerative hip, and the convalescent period is quite short. It is usually possible for the patient to get out of bed within a few days and to resume his normal activities within three or four weeks. It is for this reason that it is useful. The operation used most frequently is the section of the common obturator nerve inside the pelvis. In a paper in 1948 we⁴ reported 21 such cases. Of these 16 obtained sufficient improvement to justify the procedure and 9 of the 16 were completely relieved of their pain. With the relief of pain it is sometimes surprising that a considerable increase in movement may be obtained. This is because part of the restriction of movement is due to muscle spasm. The operation may be combined with subcutaneous tenotomy and manipulation of the hip. This operation is seldom used at present because (1) we cannot be sure how much relief will occur, and (2) the relief is not always of long duration.

Other methods of denervation of the hip are section of one or both branches of the obturator nerve in the thigh after it passes out through the foramen. Usually only the posterior or deep branch is sectioned, as this carries more of the nerve supply to the hip. Sometimes the sciatic nerve is exposed beneath the gluteus maximus muscle and the articular branch of this nerve, which is also the motor branch to the quadratus femoris muscle, is sectioned where it comes off the sciatic. In doing this operation, it is customary to section all soft tissue covering the bone adjacent to the posterior lip of the acetabulum. On rare occasions the femoral nerve is exposed and branches in the upper thigh are sectioned or avulsed because sometimes these carry sensory fibers to the hip. This last operation is done only when pain persists after the obturator and the sciatic filaments have been divided. Some surgeons now recommend that obturator and sciatic nerves be blocked by local anesthesia before the operation is done in order to determine whether or not a satisfactory result will be obtained by operation. We have tried this method, and have found it to be helpful in deciding how much benefit can be expected from neurectomy. Pain relief is usually greater following section of the nerve than by novocaine block. In our experience, limited to the obturator neurectomy, we usually choose patients in whom most of the pain is in the front of the hip and anterior and mesial portion of the thigh and knee, especially those who have an adduction contracture of the hip. The obturator neurectomy may be followed by an arthroplasty or some other surgical procedure if it does not give sufficient relief.

Capsulectomy. During recent years we have excised the capsule of the hip in a few cases, because in many of these patients the capsule, when exposed at operation, appeared to be unusually tight, offering considerable limitation to the hip joint movement and may have been causing pain. As the capsule carries sensory nerves the capsulectomy includes partial neurectomy. The operation is a fairly extensive one but is not followed by prolonged convalescence in bed. Postoperatively, the hip is immobilized by traction for about two weeks. The patient may be allowed up on crutches within a few days after traction is removed and may bear weight and resume function as soon as possible. The period of pain relief is uncertain and after a time it tends to recur.

Acetabuloplasty. One of the oldest operations for the relief of the symptoms in degenerative arthritis of the hip is cheilotomy. During recent years the operation has been modified by Smith-Petersen⁷ who introduced the term, *acetabuloplasty*. This consists of removal of a portion of the roof of the acetabulum and of the anterior portion of its wall and the adjacent portion of the capsule of the hip joint. Magnuson⁶ has described an operation known as *debridement* of the hip which is a very extensive cheilotomy, plus removal of any hypertrophied synovial tissue and excision of softened and degenerating cartilage from the articulating surfaces.

When we do an acetabuloplasty, we also do a rather extensive cheilotomy and excision of the capsule and occasionally have combined it with obturator neurectomy and adductor tenotomy, the object being to remove mechanical interference with hip function and obtain relief from pain. In certain individuals the operation has been quite successful. We believe that the patient most amenable to this type of operation has a femur with a large, flat head which has wandered out toward the greater trochanter such as occurs in old Legg-Perthes' disease. As with neurectomy, cheilotomy is not a final procedure and if the results are unsatisfactory, it can be followed by some other procedure at a later date.

Osteotomy. Various types of osteotomy of the hip have been practiced in an effort to relieve pain and improve function. The one which we have used is the high oblique osteotomy of McMurray.⁵ In his paper he reports 42 cases and states that all obtained relief from pain and that the range of motion was not reduced more than 50 per cent of preoperative range. In our hands the operation has resulted in some excellent results with relief from pain and improvement in function, but in other cases results have been disappointing. Consequently, we believe that the outcome of this operation is as unpredictable as in the two previous operative procedures and have largely discontinued its use. McMurray kept his patients in a plaster of paris hip spica cast for three and one-half months and this prolonged immobilization may have been a factor in his results.

Some years ago, in order to avoid the prolonged immobilization, we began using internal fixation with one or two large screws. Now that these three flanged nails or blades, or splints with plates attached, are available we use these for internal fixation and fix the fragments much as we do those of intertrochanteric fractures of the femur. While this lessens the necessity for external fixation or postoperative rest in bed, it adds to the gravity of the procedure. The advantage of the osteotomy is that after it is done the patient should retain or increase preoperative range of movement in the hip. It changes the line of weight-bearing of the femur, thus adding to the stability of the joint and altering the mechanics so that the hip is used in a position of relative abduction. However, the disease process is not altered and we may expect return of pain in time.

Arthrodesis. The most certain way of relieving pain in the arthritic hip is to obtain a solid bony ankylosis of the joint. In patients with degenerative arthritis this is a difficult procedure and even after a well executed operation the hip may fail to fuse. Evidence of this is readily seen in the large variety of operations for

arthrodesis of the hip which are recorded in the literature. We have used many types and are still undecided just which is best. During recent years we have combined internal fixation, either with a long Smith-Petersen nail or with bone grafts which pass across the joint and extend well into the ilium, in addition to extra-articular grafts, and have, in most cases, obtained a satisfactory ankylosis. In our hands, however, the operation has required postoperative immobilization in a plaster spica for about three months. This is especially true in degenerative hip disease where the articular surfaces are eburnated and where little in the way of new bone formation can be expected either from the head of the femur or from the opposing surfaces of the acetabulum. We have not used the osteotomy and ischial arthrodesis of Brittain in these cases.

Contraindications to an arthrodesis are disease of the other hip, old age or obesity. The operation is most satisfactory in unilateral disease in relatively young people and, if successful, may be depended upon to give a strong painless hip which will last indefinitely. Unfortunately, movement of the hip is lost completely and not only do these patients have difficulty in sitting, but they are rarely able to put on their own shoes and they may develop pain and disability in the *lower back* as a result of increased movement of the pelvis in walking or sitting. Furthermore, most of the older patients do not want a stiff hip even though there is but little motion remaining at the time they are seen, so that arthrodesis is seldom done in any except the relatively young patient with unilateral hip disease.

Arthroplasty. For a good many years attempts have been made to reconstruct new joints and this has been especially true of the hip. In the earlier days fascia taken from the lateral aspect of the patient's thigh, or various forms of animal membrane were used. Later, Smith-Petersen⁸ developed a *cup*, first of glass or plastic and finally of vitallium, and to date this has been the most popular procedure. The *cup* is fitted loosely over the head of the femur and placed in the reamed out acetabulum, with both articular surfaces removed to permit free movement of the *cup* against both bone surfaces. The operation is a rather extensive one, but with modern technic it can be done with relative safety in patients in the seventh decade. On the other hand, in older patients the muscle power is usually so poor (fig. 1) and the reactions so slow that considerable difficulty is experienced in restoring function to the joint. Very satisfactory results have been recorded by Gibson³, Bickel, Ghormley and Coventry², and by Badgley¹. Our results with this operation are not so good and they are certainly unpredictable. It is possible that our poor results are due to improper or insufficient after-treatment or to improper selection of patients. We do not believe that we should recommend an arthroplasty of the hip of an arthritic patient who is able to get along and earn his living or carry on his usual activities with only a moderate amount of pain and disability.

In our opinion, the operation should result in a better hip with better function and less pain than the patient has before he is operated upon. Consequently, we reserve it for those patients, with severe pain not amenable to conservative meas-

ures, who are more or less completely disabled and unable to carry on a normal life or to earn their living. It is perhaps for this reason that our results are not as good as some of those reported in the literature.

More recently the operation of arthroplasty has been modified by the use of a prosthetic device of one type or another which is fixed to the femur, and the head of which is inserted into the acetabulum after the head and neck have been removed. The type of prosthesis to be used depends partly upon how much of the head and neck of the femur are preserved. An amazing number of these procedures has been done. At the 1953 meeting of the American Academy of Orthopedic Surgeons, the Committee for Scientific Investigation gave a preliminary report on hip prosthesis which included data on over 6,000 cases. The

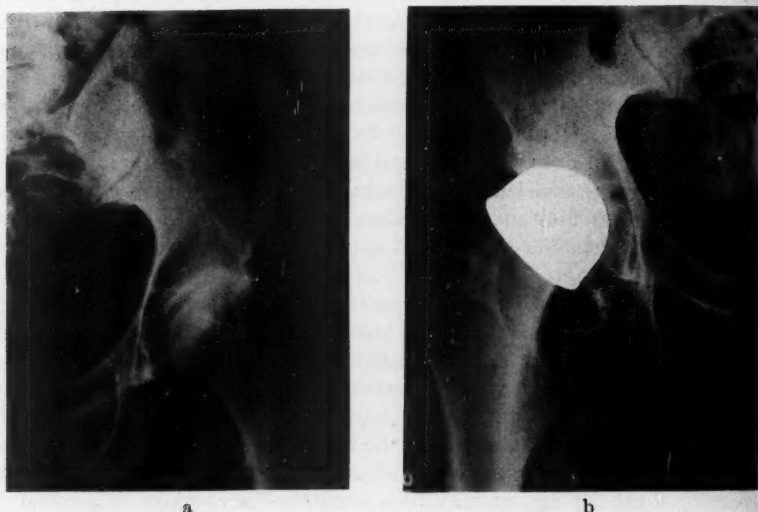


FIG. 1. (a) Anteroposterior view of hip of a 53 year old white man showing degenerative arthritis of the hip with justa-articular cyst. (b) Recent view following vitallium cup arthroplasty. There is some new bone over the trochanter. This man, however, is working while standing on his feet each day with very little difficulty.

largest group was those cases operated upon for degenerative arthritis of the hip. From the number of complications reported it is obvious that much has to be learned, both as to the type of prosthesis to use and the technic of the operative procedure, as well as to the type of patient and postoperative treatment, before this can be considered a satisfactory method. It must then stand the test of time.

Our experience with this type of arthroplasty is quite limited. We have used the stainless steel model of the Judet prosthesis (Naden-Reith) (fig. 2) in patients who have a remaining head and neck of the femur of satisfactory length and structure. This conserves more of the upper end of the femur; maintains length, and should provide normal weight-bearing stress. If the proper equipment is at

hand the operation is frequently less difficult than a *cup* arthroplasty. The postoperative treatment requires immobilization (in a cast or in bed with traction)

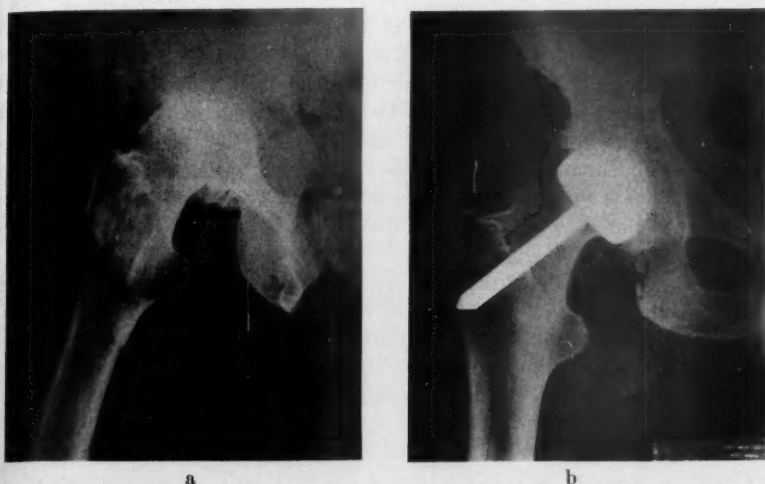


FIG. 2. (a) Preoperative appearance of degenerative arthritis of hip in a 72 year old white man. (b) Postoperative appearance following Judet type prosthesis.

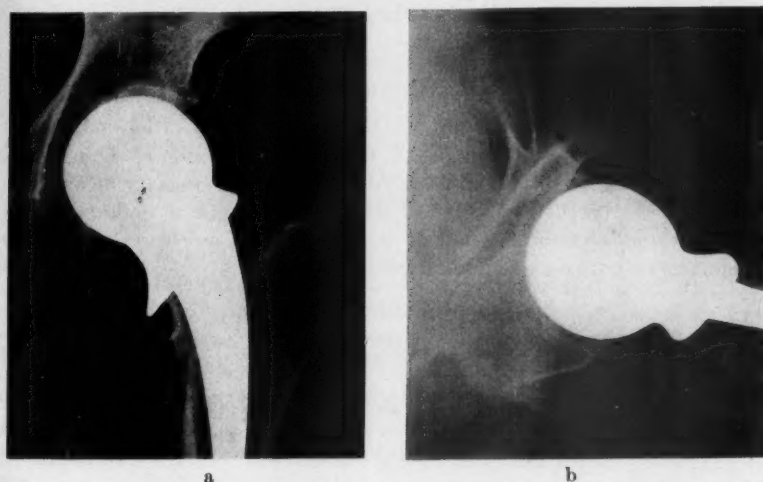


FIG. 3. (a) and (b) Anteroposterior and lateral views of hip following insertion of Fred Thompson prosthesis. Not enough of the neck of the femur was removed so that there was actual increase in the length of the leg. The patient, however, rapidly adjusted to this and now has a normal gait, with a stable painless hip.

for three weeks for healing of the soft parts to prevent dislocation. This is followed by the same type and period of rehabilitation as required for a *cup* arthro-

plasty. Some of the cases operated upon in this manner have had good results, however, others retain marked restriction of motion, limp and some pain. So far, we doubt if they are better than a properly done *cup* arthroplasty. Furthermore, when complications arise, such as infection or dislocation, they are as a rule more difficult to treat.

We have also had limited experience with the Fred Thompson (fig. 3) and Austin-Moore prostheses in cases in which adequate length of the neck is not present. These operations are usually done by using the lateral or Gibson approach. A complete capsulectomy is done as well as sectioning of the external rotators, if there is an external rotation deformity. The acetabulum is prepared to receive the new head, as would be done for a *cup*, except that not as much of the rim is involved.

Care must be used to see that the size of the prosthetic head is such that it fits loosely in the acetabulum. Also, that it fits well to the femur. Sufficient dissection must be done that after the prosthesis is fixed to the femur, reduction can be accomplished without excessive trauma because fractures of the femur have occurred at this stage. Furthermore, a few cases have been reported in which the *fit* was so tight that the hip squeaked on motion.

It is our present opinion that in those cases with loss of part of the head and neck, such as a nonunion of a fracture of the neck with aseptic necrosis of the head, a prosthesis gives a better result than any other reconstruction of the hip. However, it is too soon to know how well or how long they will stand up and the reports of complications are already so large that use of a replacement prosthesis must be given very careful consideration.

SUMMARY

Degenerative arthritis of the hip is a common condition of late adult life in which the etiology is not always known. Careful consideration of the patient as a whole, as well as his social and financial demands, are necessary before a plan of treatment can be outlined. Surgical therapy should not be undertaken until conservative management has failed, and in planning any surgical procedure the more simple procedure should be tried first.

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EMOTIONAL ASPECTS OF SURGICAL PRACTICE

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After a long period in medicine of emphasis on specialization and compartmentalization, recent years have witnessed signs of a trend in the opposite direction, toward a fuller integration of the various disciplines in the study and treatment of patients. Yet the undeveloped liaison between surgery and psychiatry constitutes a lag in this general process. It is the purpose of this paper to inquire into this situation, examining the evidence as to its origin and meaning and reviewing some of the points of contact between the two disciplines.

The *status quo* has often a superficial appearance of normalcy, and so it has been in the case in question. As a medical student, interne, and resident, one perceives that consultation requests and other contacts between surgery and psychiatry are few. It comes to be taken for granted. Yet, if one is forced to make a survey of the situation, an element, common to both surgical and psychiatric practice, is found which is of such magnitude as to make of the poor surgical-psychiatric liaison a major paradox. The common element is this: *the patient facing surgical treatment, like the patient facing psychiatric treatment, has to deal with an emotional crisis more frequently than is the case with patients handled by any of the other medical specialties.* As a corollary the same parallel holds true for the families of such patients.

A qualification may be introduced here: In the case of the psychiatric patient the emotional stress is usually primary and basic to the patient's having come to the doctor; in the case of the surgical patient it is usually secondary to an awareness of the organic disease and the prospect of surgical treatment. This qualification is, however, only a partial and relative one. In the psychiatric patient further emotional stresses frequently develop as a reaction to treatment, and in the patient coming to the surgeon it is frequently found that emotional, as well as organic, factors have led to the consultation.

The attitudes of surgeons and psychiatrists toward one another, which have permitted the partial perpetuation of their anachronistic relationship, are widely known. They include an indefensibly large amount of criticism and suspicion, albeit cloaked in a jesting tone. One of the most frequently heard comments of surgeons about psychiatrists is that they *do too little and do it too slowly*. On the other hand, psychiatrists have frequently maintained that surgeons *do too much and do it too rapidly*. Many of the jokes surgeons—and others—tell about psychiatrists have to do with the psychiatrists' *being too much like their patients (over-identifying with them)*. Many of the jokes psychiatrists—and others—tell about surgeons have to do with the surgeons' *having a preoccupation with diseased organs and too little human fellow-feeling for their patients (under-identifying with them)*.

There is ample room for humor here, but it might more constructively consist

in surgeons' and psychiatrists' *laughing at themselves for their own blind spots*. There is also room for a serious attempt to locate the fire behind all this smoke, discern its origins, and put it out.

This fire-fighting, or prejudice-fighting, has little chance of success unless it is a truly cooperative effort. Each participant should speak of that which he knows best. Accordingly this paper, in an effort to furnish motivation for the prejudice-fighting, will concern itself with areas in which psychiatry can be of use to surgery. Since prejudices, themselves, are a psychological matter, a few comments seem in order about the functioning and possible sources of the ones in question.

A good starting-point is to be found in the trends of that medical humor just alluded to. Much of it is, in essence, caricature, and in all good caricature there is a nucleus of truth. Without it the jest would seem either insipid or fantastic. On the other hand, a selective distortion is also required to get the point across, to make it funny. Much of the distortion involves an exaggeration of certain interests, traits, or problems, in the person caricatured with an implied denial of similar interests, traits, or problems in the narrator and listener.

An example is afforded by that class of jokes portraying the surgeon as completely removing the organic seat of disease, but with considerable havoc to the rest of the patient. The inference is that psychiatrists never do anything comparable. That this inference is not justified is evidenced by the fact that there are few psychiatrists who have never become so involved with the removal of some colorful symptom—for example, a hand-washing compulsion—that their therapy has neglected other aspects of the patient's personality with unfortunate results—perhaps a psychotic episode. There is the further implication that this sort of therapeutic error is frequent, which is another exaggeration.

Having said so much about the distortion in this instance, what of the nucleus of truth? Perhaps it is that there are certain factors in the personal experiences and professional training of surgeons which favor or even require putting great emphasis on isolating and rapidly dealing with certain objective factors, occasionally rendering difficult a concomitant full appreciation of subjective elements affecting the total organism. (Obviously a marked degree of cool objectivity is very frequently in the patient's interest.)

An equally good example is furnished by those jokes portraying the psychiatrist as one who deals pre-eminently with patients who are eccentric, disorientated, wildly deluded, or picturesequely hallucinating and one who is eccentric, disorientated, deluded, or hallucinating himself. The inference is that surgeons and their patients are never to be similarly regarded. As in the previous example there is an obvious quantitative distortion here. Another distortion is evidenced by the fact that it is not so much a different *kind* of patient who is seen by the psychiatrist as it is that the patient is seen at a different crisis-period in his life, i.e., one in which certain medical problems (the derivatives of inner conflicts) are in the foreground and certain other medical problems (the derivatives of infection, neoplasm, etc.) are in the background.

One may again ask, "What of the nucleus of truth?" It is probable that a

major motivation leading one to endeavor to understand and relieve emotional distress in others is to have experienced such distress. Obviously the mere experience of such difficulties without their resolution cannot make a psychotherapist, but the existence of such personal problems may represent the kernel of truth here.

This matter of unconscious motivations and their influences on choice of life-work merits further comment. Such factors effect surgeons and psychiatrists (and all men) but their nature varies and their effects vary, thus making for real difficulties in effective communication and mutual understanding. Both surgeons and psychiatrists are to some extent led or driven to their respective life works by inner needs of which they are (at least initially) not fully aware. It appears that the needs of the surgeon influence him to turn primarily outward (to comprehend and deal with anatomic and pathologic facts outside himself). It appears that the psychiatrist's needs influence him to turn inward to a greater extent (to comprehend emotional facts which must be rather fully dealt with in himself before he can be of much use to others).

For the surgeon and the psychiatrist to talk understandingly and cordially together has not been easy, partly because of a mere language difficulty, but more importantly because each must have felt the orientation of the other to be in certain respects alien or threatening to his own. Related to this feeling may be other attitudes which can interfere with the development of a workable fellow-feeling between surgeons and psychiatrists. One of these attitudes may be akin to envy of the techniques and knowledge of the members of the other discipline. It is only possible for me to speak for the psychiatrists, leaving it an open question whether some counterpart to this attitude may exist among surgeons. I am sure, however, that the psychiatrist has often wished that he could define psychopathologic problems as clearly as the surgeon can usually define organic pathologic problems and that he could treat them with as precise therapeutic means.

One of the most practical approaches to the problem of easing the interdisciplinary tension lies in delineating ways in which both specialties may fuse their understanding in the attempt to be of maximum use to the patient.* One further word of clarification is indicated. What follows is not meant to suggest that a large proportion of surgical patients should receive a psychiatric consultation. It is meant to suggest that a *rapprochement* of surgeons and psychiatrists with an *integration of concepts and principles* would render the management of the patient by the doctor in charge more effective.

The starting point for this delineation can be the observation noted earlier, i.e., that serious emotional stress is to be found and somehow dealt with in surgical practice with considerable frequency. Recently several of my surgical colleagues listed the situations which they found in the course of practice often to be fraught with emotional tension in their patients or patients' families. Here

* It seems fair to say that, at the present time, through the great contributions surgery makes to psychiatry in certain neurosurgical and psychosurgical procedures, the surgeons are somewhat ahead of the psychiatrists in forging a bridge to link closely the two disciplines.

is the composite list—which makes no pretense of being complete. The topics starred are those which were mentioned in every individual list.

The diagnostic examination with an apprehensive patient.

- ★ Telling the patient his diagnosis, particularly when it involves a poor or fatal prognosis.

Preoperative management.

- ★ Obtaining the operative permit from a reluctant patient.
- Handling the patient's family in a complicated case.
- ★ Management of the chronically and/or fatally ill patient.
- ★ Obtaining permission for the postmortem examination.
- ★ Mutilating operations (those with loss or damage to externally visible parts of the body).
- ★ Operation—proneness.
- ★ Intractable pain, including *phantom limb* pain.
- Problems involving fertility and infertility.

In addition to the aspects of routine general surgical practice mentioned in this list, there are a number of conditions or situations having obvious psychiatric features. Such conditions include postoperative delirium, suicide attempts requiring surgical care, postoperative psychoses other than delirium, anxiety reactions, and certain differential diagnostic problems, involving, besides a possible surgical condition, conversion hysteria, hypochondriasis, or psychosis with delusional ideas about the body. Such conditions will not be discussed here, but they do frequently offer real opportunities for productive collaboration between surgeon and psychiatrist.

The remainder of this paper will be devoted to brief consideration of the starred topics,[†] emphasizing the constant interweaving of physical and psychologic elements. In no instance is the discussion thought of as doing more than pointing out problems of joint interest to surgery and psychiatry and suggesting approaches to some of the answers.

DISCLOSURE OF THE DIAGNOSIS

The management of this problem is clearly a serious, often a rather difficult, matter and one which may have a critical bearing upon the subsequent therapeutic course. The situation varies greatly, depending partly upon the varying personalities of patients, partly upon the varying personalities of doctors, and partly upon the kind of news which is to be conveyed.

The most difficult situations are those in which a diagnosis has been reached which involves a fatal prognosis, for example, one of metastatic malignancy. Here a clear throw-back exists from the doctor's first objective, to save the patient's life, to his second, to make the patient's life as comfortable as possible. In such situations a fundamental approach would seem to be this: the most important therapeutic measure remaining is now use of the doctor-patient re-

[†] With the exception of the subject of intractable pain which is too complex to admit of the brief treatment possible here.

lationship, itself, and therefore whatever strengthens this relationship—whatever furthers the patient's awareness of the resources of courage, strength, steadfastness, and honesty offered him by the doctor—is apt to be therapeutically correct, and whatever weakens this relationship is apt to be incorrect.

It should be recognized that adherence to this principle may not be easy. There is a feeling of frustration and perhaps a subtle injury to one's self esteem in being faced with a condition one cannot cure. Awareness of the patient's anxiety, if it is considerable, may engender a certain degree of answering anxiety in the doctor. This anxiety may be somewhat increased by the feeling of helplessness. These factors, particularly if unrecognized, may act as forces opposing the development and maintenance of a relationship of deep, mutual confidence between doctor and patient. Full recognition and consideration of them, as they may apply in any individual case, is often, *per se*, an adequate antidote.

The questions: when, how, and what to tell the patient with incurable disease should be evaluated within the framework of the doctor-patient relationship. Obviously no hard and fast rule can be given. If, however, the above line of reasoning is accepted, the general conclusion would be that patients should be told the truth about their condition more frequently than has usually been done, and that thereafter the contact between patient and doctor should not be lessened, but, if at all possible, increased for the duration of the patient's illness.

All of us have heard the argument that it is always *easier for the patient if he does not know*, coupled with the qualification that some other member of the family should be informed. In a recent, informal inquiry into this matter by certain of my surgical colleagues and me, a number of factors calling for a modification of such a statement have seemed apparent. One of them is that the assumption that a member of the patient's family is better able to sustain the bad news than is the patient, is often not borne out. Another is that nearly all such patients become inwardly aware of the situation before the end, no matter how it is handled, even though they may keep up some pretense to the contrary. Usually—and this is evidenced by changes in mood, in dreams, in slips of the tongue, and other, perhaps subtler, ways—the awareness comes considerably before the end. Whether born of intuition or logical deductions, this awareness often brings with it a feeling of disillusionment toward the doctor and of aloneness in the situation, which contributes greatly to the patient's inner fears and discomfort, quite overbalancing any presumed initial gain from withholding the truth.

To summarize: one might say that in a majority of patients it is most harmful to say nothing; less harmful (but often impossible) to tell a convincing *white lie*; and least harmful to tell the truth.

Management of the Fatally Ill Patient

The above discussion leads naturally to a further consideration of the ways in which the surgeon can best relieve the emotional stresses of those of his patients who are chronically, perhaps fatally, ill. In very many instances the patient has been referred to the surgeon by an internist or general practitioner, and the referring physician may have a long-standing professional relationship with the

patient. In such cases the bulk of the supportive therapy of the chronically and/or fatally ill patient may well fall to the referring physician after the surgical consultation has been completed. Even here, however, the surgeon's continued manifestation of interest and concern for the patient is of real value because of his prestige.

In this situation the patient may be carrying a heavy load of anxiety. The incapacitation, the helplessness, the pain, the family's discomfort, the threat of death, plus pre-existing neurotic conflicts mobilized by the crisis—all of these may contribute to the patient's deep inner distress. If, under such circumstances, the surgeon's whole attitude and behavior and continued interest can convey to the patient the message: "I have faced such situations before. I have confidence in you and mean to stand by and see this through with you, helping you to bear what is to be borne," the service rendered may be of the highest value. Giving up with regard to the disease need not be synonymous with giving up the patient.

Obtaining the Operative Permit

In a majority of cases obtaining permission to operate once a surgical diagnosis has been established is a fairly routine matter, carried out by an approach to the patient which is essentially logical. Within the memory of most surgeons, however, are a number of instances in which, despite the proven existence of grave, potentially fatal disease, remediable through prompt surgical intervention, permission for such intervention was not granted by the patient—and this even though the explanation of the situation may have been thorough and the patient of normal intelligence.

In seeking how better to comprehend and perhaps to modify such situations, to what body of data can one turn? Fundamentally, such behavior on the part of the patient constitutes a specific instance of the more general problem of self-destruction or suicide, and much of the data which has been accumulated relative to the motivation for suicidal acts is very pertinent here. Once this relationship is recognized, the illogicalness of the patient's behavior seems somewhat less strange, for it has been repeatedly shown that suicide is probably never an act determined purely by logic, and rarely an act determined principally by logic.

Intuitive recognition by surgeons that such patients are emotionally as well as physically ill is shown by their awareness that if the patients are merely tricked, cajoled, or forced into accepting surgery, they are the very ones in whom, despite their superficial, conscious cooperation, various complications almost regularly ensue. With this reluctance to use mere cajolery, etc., most psychiatrists would fully agree. On the other hand, if the recognition of an underlying emotional disturbance, (akin to that in suicide) becomes scientific as well as intuitive, it then has certain implications regarding therapeutic management.

One such implication is that the responsibility of the medical profession toward patients refusing a life-saving operation should frequently be considered as going beyond the mere laying of the facts before the patient. Otherwise, in many instances, the situation would be somewhat comparable to that of confining one's assistance to a patient, expressing the intention of taking a massive overdose of

barbiturates, merely to pointing out that such a course of action would be injurious or fatal.

Another implication is that the emotional determinants of the patient's illogical behavior are partially, perhaps very largely, beyond the range of his immediate (conscious) awareness. What thus is called for is a thoughtful interview or series of interviews between doctor and patient in the attempt to elucidate the patient's motivation and effect some modification of it. If such an attempt is unsuccessful or impractical, psychiatric consultation is frequently indicated.

One of the emotional factors which experience has shown often to be of significance in such patients is a strong, albeit largely unconscious, sense of guilt. Since the goal here is not a fundamental reorientation of the patient's personality but merely a partial alleviation of such interfering feelings sufficient to permit a more realistic response to the physical crisis, it is often capable of realization without a protracted period of intensive psychotherapy.

As an example of the way in which unconscious emotional factors may operate in such situations, the following case may be cited. A married Negro woman in her early forties was seen on the surgical service of the Cincinnati General Hospital, where the diagnosis of carcinoma of the bowel was made. The condition was deemed operable, but the procedure would involve an ileostomy with the wearing of a pad. The patient was of average intelligence and the seriousness of her condition was fully explained to her. Nevertheless she refused to grant permission for the operation.

The patient was seen in half-a-dozen interviews over a three day period and the following relevant material was obtained. The patient had had very mixed feelings toward her own mother, a possessive and demanding woman. Following a stroke the mother had been nursed through a protracted final illness by the patient, who was extremely conscientious. The mother was incontinent of feces during most of this period. Unconsciously the daughter experienced intense resentment at the sacrifices demanded of her by the mother. Her services involved constant attempts to keep the mother physically clean.

Guilt feelings over this resentment were great and became further intensified at the mother's death. In the current situation, the patient unconsciously felt that she would occupy her mother's position and would be the recipient of feelings from her own teen age daughter like those she had experienced toward her mother.

Although the patient could not have put these thoughts into words, death seemed preferable to this intense reactivation of the old conflictory situation (and a fitting punishment for her having hated her mother).

During the course of the interviews the patient was enabled to see some of these connections. Deep interpretations about the extent and first sources of the hostility to the mother did not have to be attempted. Nor was the unconscious meaning of the fecal incontinence emphasized. Stress was placed on the similarity of the two situations and on the patient's unjustified wish to spare the daughter all nursing responsibility. With ventilation of some of her feelings about mother and daughter; with some reassurance from the doctor; with some severity from him, i.e., about the short-sighted way the patient had been looking at things; and with promise of some environmental manipulation (getting a visiting nurse in to help during convalescence), the patient's attitude changed sufficiently that she granted permission for the operation.

Obtaining the Postmortem

The emotional situation which exists when the relatives of a deceased patient refuse permission for a postmortem examination has clear similarities to the

situation in which the patient refuses operative permission. Here, too, a procedure is being recommended which is essentially surgical and which can be defended with sound logic, yet which is often refused because of emotional factors, perhaps largely unconscious. The similarity goes yet further, for again guilt feelings are prominent in motivating the refusal. One often hears this implied in such comments as: "After all that he has suffered, I can't bear to think of his body being cut open." Another element in the family's motivation may be hostility to the doctor.

Since less is at stake here than in the previously considered situation, less effort to modify the interfering attitudes is justified. One well recognized point is that the relationship between the doctor and the patient's family is often of decisive importance in such situations. If it has been at all good, the possibility of the deceased patient's doctor obtaining the autopsy permission is appreciably better than that of a strange (to the family) doctor doing so. Accordingly the delegation of the responsibility of obtaining such permission, if success is at all important, is often ill-advised.

A second point is that, in requesting autopsy permission, logical arguments supplemented by a sincere attempt to understand the specific emotional position of the family and partially to meet certain of their emotional needs (for example, by offering reassurance against guilt feelings if they are present), are more effective than logical arguments alone.

Mutilating Operations

It has long been understood that patients for whom an operation involving removal or alteration of an externally visible part of the body is recommended face serious emotional stress (as well as physical stress) and may respond to the procedure with a variety of psychological symptoms, some of which may even affect the long-term results of the operation.

Certain stressful elements are obvious and, as a rule, receive attention in pre-operative and postoperative management and planning. For example; loss or disfigurement of a part of the body may be a severe, direct blow to the patient's self esteem and confidence. In addition it may markedly reduce the patient's earning capacity, thus constituting a further thrust at the patient's feelings of worth-whileness and independence. Moreover there is very frequently created (at least temporarily) an imbalance in the patient's family and other interpersonal relationships either directly or as a result of secondary factors.

The recent remarkable advances in physical medicine and rehabilitation have done a great deal to offset the force of these blows and to enable the patient to overcome them. Nevertheless, even in fairly routine cases, an appreciable amount of further help can be given the patient by his doctor, if the latter is fully cognizant of these psychologic effects and encourages the patient freely to ventilate his feelings both before the procedure and during his convalescence. The doctor's interest, understanding, advice, and reassurance can mean a great deal in these circumstances.

A certain number of patients undergoing such operations present more complex

or more serious emotional problems than do those just considered. Such responses are apt to occur if (1) the patient's general feelings of inadequacy or insecurity (prior to the situation calling for operative intervention) are quite great and the surgical disease represents a sort of last straw, or (2) the disease and/or operative intervention has a highly specific, disturbing meaning for the patient. In the second instance, the meaning could be largely realistic or largely neurotic; probably in most instances it is a combination of both elements.

An example of a highly specific, realistically deeply disturbing meaning would be afforded by a well adjusted patient requiring enucleation of an eye, if the pursuit of his career—let us say that of aircraft pilot—was completely impossible without binocular vision.

An example of a highly specific, neurotically deeply disturbing meaning would be afforded by a patient requiring amputation of a hand, provided strong unconscious conflicts were associated with the function of that hand. One such patient, whom I was asked to see, had become impotent following a partial amputation of the left hand. The patient was right-handed and engaged in an occupation which did not require use of the left hand. It developed, however, that, as a boy, the patient had been threatened by his father with having his hands cut off if he continued to masturbate. His masturbation, which was attended by severe anxiety and guilt feelings, had been practiced with the left hand.

An example of a clearly discernible fusion of realistic and neurotic meanings (both important) would be afforded by another patient seen recently. In this case the patient was a fashion model and the operative procedure was a radical mastectomy. Here the realistic element is obvious. In addition, however, as is frequently the case with professional models, the patient's entire feeling of personal worth leaned very heavily upon the perfection of her external appearance. Hence the neurotic element was also very great, and the two elements combined in a way which was nearly catastrophic to the patient's personality.

In a number of instances patients falling into the categories just summarized will be sufficiently disturbed as to require psychiatric attention. Even here the surgeon can render the patient a real service (beyond that of the operation, itself) by spotting the emotional complications *in statu nascendi* and making a prompt referral. In other instances the surgeon's awareness of the possibility of such factors coming significantly into play, his developing a basically good relationship with the patient, and his careful and sympathetic discussion of the situation with the patient may forestall or abort such serious developments.

Operation Proneness

From an over-all point of view there seems to be little doubt that the problem of patients' receiving unnecessary but desired operations is somewhat ameliorating. Very likely this favorable trend is due in part to the constant advance in diagnostic technics and in part to the increasing realization that such patients often become—to put it mildly—serious nuisances to the doctor. Nevertheless a frank scrutiny of the pathologist's reports at almost any modern hospital reveals that patients do receive unnecessary operations occasionally, and a similar look

into the personal histories of such patients reveals that frequently the patients' own drive to be operated upon (often manifested in subtle and indirect ways) has been an important factor in bringing about the operation.

Probably it is a very rare occurrence for an operation to be done by a surgeon in whose mind there exists no doubt that the procedure is unnecessary or inadvisable. On the other hand, if there are clear-cut surgical indications for the procedure, the question of operation-proneness becomes of decidedly secondary importance, even if the patient's motivation for undergoing the operation is largely neurotic. In the main, therefore, the factor of operation-proneness must exert its significant influence in that range of cases where some doubt exists in the surgeon's mind as to the necessity or advisability of the operation.

Before further comment as to evaluating and handling such influence, it should be mentioned that operative intervention in the case of the patient who is reasonably sound organically but operation-prone can often be more than just the mistaken application of the doctor's time and effort and of the patient's money. In a long-term sense it can be directly harmful to the patient. Operation-proneness is not completely understood, but one aspect of the condition which is understood is this: such patients are using their bodies in a destructive fashion to gratify certain (unconscious) neurotic needs. Their hope for the future lies not in continuing to use such means of gratification, but in coming to understand these needs and in modifying them. Such understanding is what the patients are fleeing from in seeking repeated gratification through surgery.

Returning to the previous discussion, one is drawn to the conclusion that certain cases, falling in the *doubtful range* as regards operative intervention should be subjected to an even closer scrutiny than usual if operation-proneness is at all suspected. Certain obvious measures would be included in such a scrutiny. For example, a careful study should be made of the patient's past history with regard to operations; the indications for them, and their therapeutic results, as well as previous attempts upon the part of the patient to obtain an operation. Another example is to note carefully the patient's current attitude toward operative intervention, i.e., to what degree such intervention is overtly or covertly welcomed.

The more difficult measure is to evaluate the effect of the patient's emotional bias, if it clearly exists, on the presenting complaints. Certainly there will always be a residuum of cases in which proper caution dictates operative intervention in the face of lingering doubts upon the part of the surgeon and eagerness upon the part of the patient, but a full awareness of the problem can make the residuum smaller.

SUMMARY AND CONCLUSIONS

Recognition is taken of the fact that the liaison between surgery and psychiatry has lagged in its development behind the growing feeling of a close interrelationship of medical disciplines.

This lag is regarded as paradoxical in view of the existence of an important common element in surgical and psychiatric practice: the fact that the patient

facing surgical intervention, like the patient facing psychiatric treatment, is called upon to deal with an emotional crisis with considerable frequency.

An inquiry is made into the causative factors involved in delaying a better surgical-psychiatric liaison. Certain differences in temperament and in professional training appear to be involved, but they do not seem at all insurmountable in the face of honest, sustained, mutual efforts at understanding.

Examples are given of situations, frequently arising in surgical practice, in which material from the field of psychiatry may prove of use to the surgeon. These examples are offered in the hope of furnishing further motivation for the development of a good relationship between the two disciplines.

CARCINOMA OF THE CECUM ASSOCIATED WITH ACUTE APPENDICITIS

A CASE REPORT

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Reports in the literature of carcinoma of the cecum in conjunction with acute appendicitis are rare. It brings up an interesting problem in preoperative diagnosis when one is confronted with classical symptoms of acute appendicitis with possible perforation of the appendix. The consideration of carcinoma is remote. Indeed it is often impossible to make an accurate diagnosis.

We have a patient who was operated upon for what was believed to be appendicitis with gangrene of the appendix. She was found to have a gangrenous appendix in addition to a carcinoma of the cecum which had perforated and the bowel contents were leaking into the abdominal cavity. Because of these dramatic and unsuspected findings and because a careful review of the literature fails to reveal any other case of simultaneous rupture of a malignancy of the cecum with acute appendicitis, we believe it is worth while to report our case.

CASE REPORT

The patient, a 60 year old white woman, suffering from severe pain in her abdomen, was brought to Research Hospital in an ambulance Nov. 10, 1952. The pain began 24 hours before admission as generalized abdominal cramps, with no relief, gradually localizing to the right lower quadrant. She was nauseated and vomited. Her vomitus contained bile, but no blood. She developed chills and fever as high as 104 F.

Her past medical history revealed the fact that she had had some bright red blood in her stools for several months, which was attributed to a local rectal condition. She had not lost weight, but indeed had gained about 5 pounds. Significantly, however, she had complained of occasional cramps in her abdomen for the past month. She paid very little attention to these cramps, since she had had pains in her right groin most of her life. She had had frequent attacks of tonsillitis for which her tonsils were removed in 1935. Since 1936 she had suffered from severe hypertrophic arthritis involving most of her peripheral joints. This condition gradually progressed until at the present time she has deformities of her hands, feet and spine. In 1948 she had a right inguinal herniorrhaphy for a hernia which she had had for 30 years. At the same time, she had a bilateral high saphenous vein ligation for varicose veins. In February 1952 she had a cystocele repaired.

Her family history reveals the fact that her mother and one sister died of cancer of the stomach. Another sister died of tuberculosis, and her father had diabetes mellitus. A brother had a peptic ulcer. There is a history of tuberculosis on her father's side of the family.

Physical Examination: She was an anemic looking woman, obviously in acute distress. Her blood pressure was 140/70, her pulse was 106 per minute and her temperature was 104 F. Her respirations were 30 per minute, shallow and thoracic. The head and neck presented no abnormalities. The heart and lungs were essentially normal, except for tachycardia. The abdomen was quite tender, slightly distended and rigid. It was extremely tender over McBurney's point and rebound tenderness was present. A mass about 5 cm. in diameter

was felt in the right lower quadrant. Peristaltic sounds were present and abdominal reflexes were absent. Pelvic examination revealed a very tender mass in the right vaginal fornix. The extremities and spine show evidence of advanced arthritis deformans.

Laboratory work: The urinalysis was normal except for many white blood cells. The hemoglobin was 9.1 Gm. per 100 cc. (64 per cent). The red blood cells were 4,000,000 per cu. mm. The white blood cells were 28,600 per cu. mm. with 94 per cent neutrophils, 1 per cent lymphocytes and 5 per cent mononuclear cells.

A diagnosis of acute appendicitis with possible perforation and abscess formation was made.

Operation: The abdomen was opened through a right pararectus incision. The peritoneum was not particularly edematous and no free pus was encountered. A mass of adhesions was present in the right lower quadrant. The appendix was located and found to be swollen and friable. In lifting it up, it detached spontaneously and a large cauliflower mass was discovered in the cecum about 1 inch below the base of the appendix. This mass was necrotic in the center and had perforated. Fecal matter was leaking into the peritoneal cavity. The cecum was mobilized and revived with 15 cm. of the terminal ileum and 15 cm. of the ascending colon. The mesentery of the ileum contained one indurated lymph node. The retroperitoneal space was explored and several hard, fixed lymph nodes were palpated over the iliac vessels. The condition of the patient did not warrant dissection of these nodes. A Penrose drain was inserted in the cul-de-sac to remain for 48 hours. The abdomen was closed in layers, using three heavy retention sutures in addition to the usual technic.

Her postoperative course was somewhat stormy for three days, with some distention and vomiting and a temperature of 102 F. Thereafter her condition improved. She had a bowel movement on the sixth postoperative day and was out of bed on the same day. Her bowels moved daily thereafter. The wound healed per primum and she was discharged on the fourteenth postoperative day.

Gross pathological report dated Nov. 10, 1952 reads in part as follows: "Grossly one identifies an ulcerating, fungating, rather typical adenocarcinoma of the cecum measuring 5 cm. in diameter. A portion of the mesentery, included with the specimen, shows a fibrinopurulent exudate over the surface. The appendix is not attached and is swollen, friable and dark in color. Multiple sections through the portion of tissue fail to reveal lymph nodes. There are 15 cm. of attached terminal ileum and 15 cm. of proximal ascending colon which show no particularly striking or unusual features." Microscopic: Sections taken through the wall of the cecum show carcinoma to be present. In one area the tissue shows marked evidence of infection and inflammatory reaction at the site of the perforation. In some areas the tumor is quite papillary and forms good acini. In other areas it is infiltrating the muscle wall and shows very little attempt at acinar formation. In a few areas it is forming mucus.

Diagnosis: High grade II papillary adenocarcinoma of the cecum with perforation (figs. 1 and 2).

DISCUSSION

A carcinoma may start in the cecum and grow for a considerable time without producing symptoms. Rankin,¹¹ Mayo⁹ and others have pointed out that carcinoma of the right colon is less likely to produce obstruction than that of the left colon. The reason is that cecal cancers are more often medullary than scirrhous. Furthermore, due to the size and shape of the cecum, a lesion can be silent for a long time before producing obstructive symptoms. Lahey found that 16 per cent of his cases of carcinoma of the large bowel were in the cecum.

Carcinoma of the cecum is sometimes mistaken for chronic appendicitis. Seegers¹³ reported 3 such cases in 1938. The association of acute appendicitis and carcinoma of the cecum is rare. In 1946 McLaughlin⁸ could collect but 11 cases in the literature, to which he added 1 of his own. His was a case which was mis-

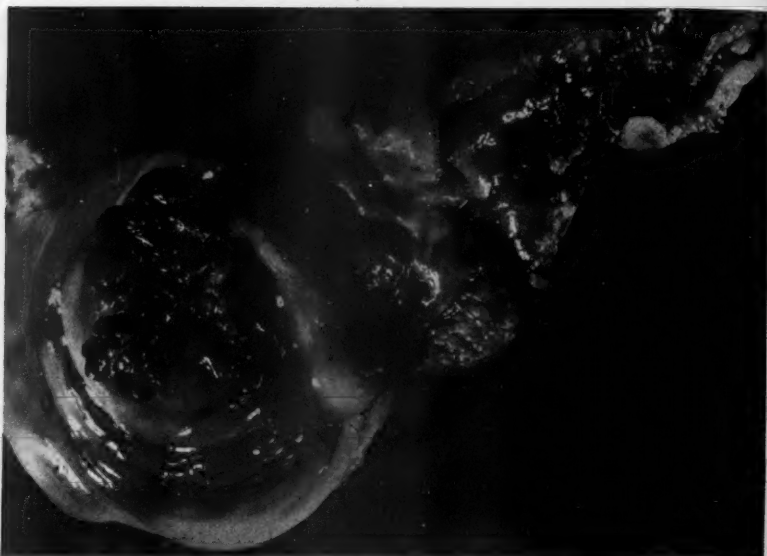


FIG. 1. Appearance of the specimen showing the carcinoma of the cecum with the perforation. The bowel has been opened and the terminal ileum is shown (the ascending colon does not appear in the photograph).

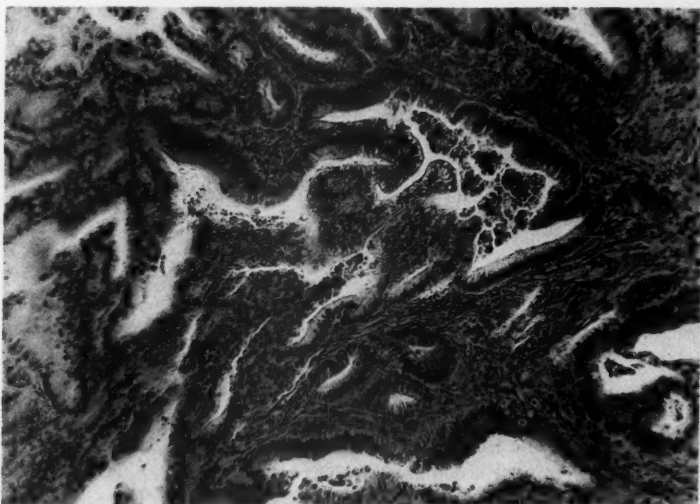


FIG. 2. Microphotograph (100X) of the lesion showing high grade II papillary adenocarcinoma infiltrating the muscularis of the cecum. Infection and inflammatory reaction is also present.

takenly operated upon for appendicitis and drained. The patient developed a persistent draining sinus for which he was subsequently reoperated upon. A

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carcinoma of the cecum was found and was successfully resected. In 1951, Hellsten and Ramstrom⁶ in Sweden, reported 7 cases of cecal cancer with initial symptoms of an abscess in the right iliac fossa. In 4 of the cases, the abscess had probably developed from concurrent appendicitis. Richter¹² reported a case from Northwestern University in 1949 of acute appendicitis associated with carcinoma of the cecum. Bohemier³ described a cancer of the cecum operated upon falsely for chronic appendicitis in 1936. This case was evidently not included in McLaughlin's survey of the literature. However, the appendix in this case was apparently not inflamed.

Because of the early nonsymptomatic growth of a carcinoma in the cecum, Wilkie¹⁴ writes that "acute appendicitis may be the first indication of this disease." Most of the cases reported in the literature have been operated upon for supposedly acute appendicitis. At operation a mass is felt in the cecum which is believed to be inflammatory. A drain is therefore introduced on the assumption that an abscess is present. The drainage persists and a fistula develops. Weeks or months later, the patient is reoperated upon and tissue for biopsy reveals the true cause of the constant drainage. Bartlett and Miller² reported 2 such cases in 1941. Cook⁵ reported 1 in 1936. Parker and Rosenthal¹⁰ reported 2 similar cases in 1933. Banks and Green¹ reported 1 case in 1935. All of these had *stage* operations, and none reported rupture of the carcinoma of the cecum.

A pathologic process such as we have described here, which produces acute inflammation in the appendix, is probably due to a blockage of the lumen of the appendix, by the proliferation of the growing tumor. Or, it might be suggested that the carcinoma becomes ulcerated and infected and thereby contaminates the adjacent appendix. In our case, the carcinoma in the cecum was evidently growing close to the base of the appendix and when it ruptured the appendix sloughed off.

Acute appendicitis may be the first evidence that finally reveals the existence of an underlying silent malignant lesion. Chamberlain⁴ and Lahey⁷ have pointed out that it is frequently difficult to diagnose the malignant lesion even with the roentgenogram. In a patient with sudden onset of symptoms and signs such as ours, roentgenographic examination could not have been made without delaying immediate necessary surgery.

Cases of carcinoma of the cecum with a gradual onset and chronic symptoms may be confused with an appendiceal abscess, subacute or chronic appendicitis, adhesions, tuberculosis, actinomycosis or colitis (Chamberlain⁴).

When the diagnosis is confirmed at the operating table, the proper treatment is removal of the right colon and ileocolostomy in one stage, if the lesion is resectable.

SUMMARY

Carcinoma of the cecum may develop insidiously and silently. It may be recognized only when an acute attack of appendicitis brings the patient to the hospital.

The encroachment of the growing carcinoma on the base of the appendix may cause it to become edematous and infected.

A review of the world literature has disclosed 19 cases of carcinoma of the cecum, concomitant with acute appendicitis.

Another case is reported herewith in which the appendix had sloughed and the carcinomatous lesion had perforated.

A one stage resection of the right colon and ileocolostomy was done and the patient made a satisfactory recovery.

The family history of gastrointestinal cancer is worthy of note in this case.

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A REVIEW OF THE DIAGNOSIS AND TREATMENT OF TOXIC GOITER

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The recognition of thyroid disease is primarily the function of the clinician, not of the laboratory technician. No single test or battery of tests can completely replace clinical judgment in either the recognition of thyroid dysfunction or an estimate of the progress of the disease.

None of the tests available today can unequivocally determine the presence or absence of thyroid disease. They may supplement the clinical impression and, in doubtful instances, lend weight in the proper diagnostic direction. The following are the tests available for determination of the status of thyroid function: (1) basal metabolic rate, (2) serum cholesterol, (3) protein-bound iodine of serum, (4) thyroid uptake of radioactive iodine and urinary excretion of radioactive iodine, (5) magnesium partition studies, (6) creatine tolerance test, and (7) therapeutic response to iodine.

BASAL METABOLIC RATE

If we accept minus 10 to plus 15 per cent as the normal range for the basal metabolic rate, we find that the basal metabolic rate is elevated in most cases of hyperthyroidism and reduced in most instances of hypothyroidism and myxedema. However, normal basal metabolic rates are found with clinically frank hyperthyroidism and even more frequently when Graves's disease is masked or borderline. Similarly, moderately elevated basal metabolic rates may be encountered in illnesses and clinical states unrelated to thyroid disease. Finally, technical errors, a hazard inherent in all laboratory procedures, may distort the results.

Fever, dyspnea caused by pulmonary or cardiac disease, severe anemia, leukemia, Hodgkin's disease, polycythemia, lymphosarcoma, coarctation of the aorta, aortic stenosis, essential hypertension, and tremor from various causes are some of the clinical states which may yield abnormally elevated metabolic readings. Undue effort before the test, an inadequate postprandial rest period, anxiety, and various subjective factors may also influence the rate.

The reasons for the normal results obtained in cases of proved hyperthyroidism are for the greater part obscure. One factor is the level of the patient's basal metabolic rate before the onset of the thyrotoxicosis. An individual whose rate prior to the onset was minus 15 per cent or less may, with the development of a relatively mild degree of thyrotoxicosis, have an increase only slightly beyond the accepted normal range, but which still constitutes a considerable increase for this particular patient.

The severity of the disease bears only a rough relationship to the basal metabolic rate. Frequently, patients with less severe manifestations and those with

pronounced exophthalmos associated with otherwise minor constitutional symptoms show less elevation of the basal metabolic rate. The role of the widespread dietary use of iodized salt may be significant in these discrepant findings. In any event, approximately 5 to 10 per cent of patients with thyrotoxicosis have readings relatively within the normal range.

The results of the basal metabolic rate are much more consistent in myxedema. Although there are other causes for a reduction in the basal metabolic rate, it is unusual not to find a marked lowering in patients who present the classical manifestations of myxedema.

The significance of slight reduction in the basal metabolic rate is more obscure. There are so many factors, physiologic and otherwise, which may produce a decrease in the rate that the diagnosis of hypothyroidism on this basis alone, in the absence of suggestive clinical signs and symptoms, is not justified.

Serum cholesterol. It is a well known fact that in cases of hypothyroidism there develops a hypercholesterolemia and conversely in hyperthyroidism the serum cholesterol tends to be reduced. Perhaps the major value of serum cholesterol determination is a possible guide to therapy. The serum level rises during the successful treatment for hyperthyroidism and falls following therapeutic response in myxedema.

Protein-bound iodine of serum. The protein-bound iodine concentration of the serum or plasma is a very sensitive index of thyroid function and reflects the level of the circulating thyroid hormone. It is, however, less satisfactory as a test of thyroid activity. The normal values vary from 3 to 8 micrograms per cent.

Uptake and urinary excretion of radioactive iodine. The radioactive isotope I^{131} , with a half-life of eight days, is the isotope most commonly used in the diagnosis of thyroid disease. For purposes of diagnosis, one may measure either uptake of the isotope by the thyroid or excretion in the urine. Measurements of uptake of the radioactive isotope are made 24 hours after ingestion of the I^{131} . Uptake is determined by the measurement of the gamma rays. A Geiger counter is placed 15 cm. from the neck with the thyroid isthmus as a center and the head and neck in a special holder. The normal value for the uptake of I^{131} by the thyroid 24 hours after administration varies from 10 to 35 per cent of the ingested dose. The major portion of an ingested dose of radioactive iodine is excreted in the urine within the first 24 hours and a much smaller quantity is excreted during the next 24 hours. A urinary excretion of 20 per cent or less is considered consistent with hyperthyroidism. Excretions between 21 and 35 per cent are regarded as borderline and values above 35 per cent are considered within normal range. The urinary excretion of I^{131} above 80 per cent after 48 hours may be interpreted as consistent with the diagnosis of myxedema and hypothyroidism. For diagnosis the dose of I^{131} varies from 40 to 100 microcuries; generally the larger dose is used.

Creatine tolerance test. In Graves's disease there is a significant creatinuria with a concomitant decrease in urinary creatine excretion.

In any consideration of hyperthyroidism we believe that the two hyperthyroid states, namely, exophthalmic goiter and adenomatous goiter with hyperthyroid-

ism should be considered separately, and in the following discussion exophthalmic goiter and adenomatous goiter with hyperthyroidism will be considered individually.

Surgical treatment. Exophthalmic goiter: The treatment of patients who have exophthalmic goiters by means of partial thyroidectomy following preparation with iodine and the antithyroid drugs has proved not only very satisfactory but extremely efficient. After preoperative preparation a thyroidectomy may be done in more than 97 per cent of patients as a single stage operation, and more than 95 per cent of such patients will remain well indefinitely after the operation. The risk of partial thyroidectomy has declined steadily; in the past few years it has become only a little greater than the risk following partial thyroidectomy in patients who have adenomatous goiters without hyperthyroidism. Indeed, statistics quoted in one of the larger universities revealed that the hospital mortality rate following operations on all patients who had exophthalmic goiters was the same as the mortality rate following thyroidectomies on patients who did not have hyperthyroidism namely: 0.3 per cent.

Partial thyroidectomies in the remaining group of 2 to 3 per cent of the total group is associated with an operative risk due essentially to severe hyperthyroidism. Most of these patients have had prolonged medical preparation and have had operations done in stages. This group also includes patients who are suffering from recurrent exophthalmic goiter and who are in poor condition; the surgery is technically more difficult and the results are fraught with a greater incidence of technical complications and tetany.

The surgical treatment of exophthalmic goiter is an empiric procedure which is obviously not directed at the cause of the disease, but rather for the relief of symptoms. It is surprising, in view of this fact that so many patients remain cured clinically and that so few recurrences develop. In theory, there is no reason why the goitrogenic drugs should not be used as the only treatment of hyperthyroidism and so largely replace thyroidectomies. It has been thought for years that exophthalmic goiter was a cyclic disease that rarely continued for longer than three or four years without prolonged remissions; so that, if administration of the drugs could be continued for this length of time there is little reason to doubt that the remissions following this treatment would be as satisfactory as those following partial thyroidectomy. However, the status of the goitrogens in respect to permanent remission has not been determined adequately and the mortality rate associated with treatment by goitrogens is greater than that associated with partial thyroidectomy.

Adenomatous goiter with hyperthyroidism. The situation is very different in the case of adenomatous goiter with hyperthyroidism. It is our belief that adenomatous goiters should be removed, not only because of the possibility that cancer of the thyroid gland, which is not clinically evident at the time of operation, may be present, but also to prevent the development of subsequent malignant lesions. Furthermore, effects other than malignancy and hyperthyroidism must be considered in such goiters, and surgery is often indicated by these rea-

sons alone. Not only is the removal of the adenomatous tissue strongly indicated, but the results of operation are more satisfactory in that recurrences are far more unusual than recurrences following thyroidectomy for exophthalmic goiter.

The hospital mortality rate following thyroidectomy for adenomatous goiter with hyperthyroidism is definitely greater than that following thyroidectomy for exophthalmic goiter. There are several reasons, one of the most important being the fact that the patients are usually older and they are more likely to have other diseases common to their age group. In addition, the onset of hyperthyroidism in adenomatous goiter is often so insidious that the diagnosis frequently is not made until serious damage has been produced. Finally partial thyroidectomy for adenomatous goiter with hyperthyroidism is often demanded because of the development of cardiac disease or to prepare the patient for operation for other serious disease. It follows, unfortunately, that the control of the hyperthyroidism in any case of adenomatous goiter with hyperthyroidism will not restore the patient to the same level of health that control of the hyperthyroidism will in the case of exophthalmic goiter. In view of the serious risk associated with any thyroidectomy done for adenomatous goiter with hyperthyroidism, and in view of the very limited control of the hyperthyroidism in such cases by iodides, there should be a definite place for the goitrogenic drugs in the pre-operative preparation of such patients. However, the goitrogens have proved less efficient in this disease than in exophthalmic goiter.

Antithyroid drugs. The term *antithyroid drugs* has been applied to a group of organic substances which tend to prevent the formation of thyroid hormone in the thyroid gland. The drugs currently in clinical use are thiouracil, propylthiouracil and methylthiouracil.

The antithyroid drugs prevent the formation of thyroglobulin, apparently by blocking an enzyme system essential to the iodination of tyrosine preparatory to the formation of thyroxine. These drugs have no influence on release of preformed hormone from the thyroid gland in the utilization of released or administered thyroid hormone. There may, therefore, be a delay of weeks or months in the induction of remission when antithyroid drugs are given to hyperthyroid patients who have large goiters or who have been previously treated with iodine. In both of these situations there is likely to be a large store of preformed thyroglobulin in the thyroid gland.

The antithyroid drugs are used clinically in the treatment of primary hyperthyroidism. In the average acute case not previously treated with iodine, adequate dose of an antithyroid drug will be followed within a week by rapid improvement in signs and symptoms and a fall in the basal metabolic rate. After the first two weeks, improvement continues at a slower rate, four to six weeks usually being required for complete disappearance of manifestations. Large glands (as in toxic nodular goiter), pretreatment with iodine, and the presence of other endocrine disturbances, may delay the onset of improvement or it may reduce its rate. Response obviously is slow and incomplete when the dose is inadequate.

The antithyroid drugs may be used to prepare patients for thyroidectomy or they may be used as medical treatment in lieu of thyroidectomy. They are definitely indicated as preoperative therapy in all but the mildest cases, in which iodine alone suffices. In more severe cases, they have the advantage over iodine of providing complete control of the hyperthyroidism for an indefinite period. The operative mortality and postoperative complications will be minimal under these conditions.

As a preoperative measure, the antithyroid drugs are given until all manifestations of hyperthyroidism have disappeared and the patient has recuperated from them to as great an extent as is deemed possible. Thyroidectomy is then done one week after discontinuation of the drug. During the last two or three weeks before operation, iodine should also be given in doses of 10 mg. daily. If the patient has been receiving iodine prior to beginning the use of an antithyroid drug, it should be continued throughout the preparatory period. It is recommended that the period of preparation for operation never be less than five weeks. In severe and complicated cases, it may be several months. The antithyroid drugs are not given postoperatively.

The usual dose of propylthiouracil given to the hyperthyroid patient is 300 mg. every 24 hours in divided doses. This is continued for approximately seven days and then it is adjusted as the response is noted. Some patients require from 200 to 400 mg. every 24 hours. After a few days the maintenance dose is determined and the patient is allowed to continue on the daily maintenance dose. A complete blood count is done weekly to determine any effect the drug may be having upon the general blood picture.

In those patients who cannot or will not be operated upon or who have suffered a recurrence of hyperthyroidism following thyroidectomy, the antithyroid drugs may be used as medical treatment. As the patient becomes clinically well, the dose should be reduced to a maintenance level to avoid the possibility of inducing hypothyroidism or myxedema. At this time, but not earlier, it is recommended that concomitant administration of iodine be begun, 10 to 30 mg. daily. Treatment should be continued without rest periods for 12 to 18 months. At the end of such a period, the drug may be gradually discontinued. However, the patient should remain under observation for an additional year because of the possibility of recurrence. If the disease is to recur, it usually does so within five months. Factors favoring persistent remission are: female sex, small goiter and mild hyperthyroidism. As more experience is gained and greater skill is acquired in the use of antithyroid drugs, the recurrence rate after their use is being reduced to approximately that following operation.

There are some interesting side effects, apparently of an allergic nature, that may follow administration of an antithyroid drug. The most serious side effect is agranulocytosis which may be fatal. All physicians should be alert to the occurrence of sore throats, fever, and malaise. Temporary leukopenias are commonly seen but there is no cause for alarm unless the white count drops to 4,500 per cu. mm. or the percentage of granulocytes is reduced to 45. Other side effects are:

exfoliative dermatitis, skin rashes, nausea and vomiting, headaches, arthralgia and drowsiness.

The antithyroid drugs may appear in the milk of lactating women in significant quantities. Women receiving them in the postpartum period should not nurse their babies. Antithyroid drugs will pass the placental barrier, but this seems to be a minor hazard if the dose is kept low and if iodine is given concomitantly.

Following is a case report of a patient who had a typical toxic goiter. The treatment of this patient is described.

CASE HISTORY

Miss D. K., aged 19, was first admitted to the hospital on April 20, 1951 with a chief complaint of nervousness. She states that she had noticed thyroid enlargement for approximately four years. Approximately six months before entering the hospital she noticed the onset of nervousness, weight loss and a voracious appetite. No other systemic changes were noted.

The physical examination revealed a greatly enlarged nodular thyroid with an audible bruit. The thyroid gland was approximately six times the normal size and the right lateral lobe and isthmus appeared to be involved more than the left lobe. She was extremely nervous and exhibited a coarse tremor. The pulse rate was in excess of 160. The remainder of the physical examination was normal. The urinalysis was normal. The blood count was normal. The basal metabolic rate was plus 65. No blood chemistry determinations were made.

This patient was given phenobarbital, high vitamin intake, high caloric diet, and morphine as necessary. Propylthiouracil was begun in 100 mg. doses every eight hours, Lugol's solution in 10 drop doses was given three times daily, and sodium iodide 15 Gr. intravenously daily were given. Under this regime, the patient's general appearance improved. The pulse rate approached normal limits and the nervous manifestations markedly subsided. She was hospitalized nine days.

While under treatment she was observed periodically in the office and on June 4, 1951 she was readmitted to the hospital. The examination of the thyroid gland at this time revealed the signs of hyperthyroidism. There was gross adenomatous enlargement, and audible bruit; the gland was fixed but not tender. The gland was soft with no areas of increased density and there was no regional adenopathy. The basal metabolic rate reading was approximately plus 20. The pulse rate was 100. The blood pressure was 110/70. The patient's condition appeared good.

On June 5, 1951, a partial thyroidectomy was done. The entire right lobe, the entire isthmus and approximately 90 per cent of the left lobe were removed. Postoperatively, the patient did well and was given only sedation of sodium luminal and Lugol's solution, 15 to 20 drops, three times daily. She was discharged on the fourth postoperative day. The wound had healed per primum. The pulse rate was 86 and the temperature was normal. There were no signs of toxicity or hyperthyroidism.

Periodic observation, postoperatively, for six months revealed the patient to be symptom free. The basal metabolic rate and pulse rate were within normal limits and all signs of nervousness had disappeared.

The patient moved to an adjoining state and a recent communication was received, stating that *patient had been examined and was apparently cured.*

CONCLUSIONS

The great majority of patients who have exophthalmic goiters can be treated by partial thyroidectomy after adequate preparation with iodine and the antithyroid drugs.

Patients who have adenomatous goiters with hyperthyroidism should be treated by partial thyroidectomy. They, too, should be treated with the goitrogenic drugs but it must be remembered that the period of preparation is more prolonged than that required in exophthalmic goiters.

The goitrogenic drugs can be used to prepare the patients so that *stage operations* may be avoided. Patients receiving the goitrogenic drugs must be closely supervised. Radioactive iodine shows great promise in the treatment of hyperthyroidism but its use is still in the experimental stage.

EDITORIAL

EARLY OPERATION FOR CONGENITAL ATRESIA OF THE BILE DUCTS

The relative frequency of obstructive jaundice in adults, as compared with its incidence in the neonatal period, has led to a greater familiarity with the problems to be encountered in dealing with patients in the older age groups. Only within recent years has sufficient published experience accumulated concerning neonatal jaundice to permit a more penetrating insight into some of its clinical features. The invaluable studies on erythroblastosis fetalis have not only provided useful laboratory methods for promptly ruling out the existence of this important hemolytic cause of jaundice but also have stimulated efforts to learn more about other conditions producing jaundice in the newborn, both nonobstructive and obstructive.

The differentiation between obstructive and nonobstructive jaundice can generally be made rather early—during the first few days of life. The principal causes of nonobstructive jaundice are erythroblastosis fetalis and icterus neonatorum. As has been suggested, erythroblastosis fetalis can be diagnosed readily by suitable agglutination tests. These tests should be made very promptly so that effective therapeutic measures can be instituted without delay. Icterus neonatorum disappears within a few days and is not accompanied by acholic stools.

Although congenital atresia of the extrahepatic bile ducts is the commonest cause of neonatal obstructive jaundice, a nonspecific type of obstructive jaundice is now being recognized with greater frequency and must be given careful consideration in the differential diagnosis of atresia. Ladd used the term *inspissated bile* to describe these cases and, despite more recent observations that inspissated bile or mucous plugs are only occasionally found, the majority of these cases continue to be so classified, principally due to the lack of a clear understanding of their basic pathology. Hsia and his associates in Boston have found that erythroblastosis is associated with this nonspecific obstruction in approximately 40 per cent of the cases and that no definite etiologic factor can be elicited in the other 60 per cent. The possibility that this obstruction, in some cases, may be a manifestation of the syndrome of mucoviscidosis has been considered by them. Their work shows great promise and it is to be hoped that their findings will result in a more rational approach to the diagnosis and management of these cases. The jaundice in the majority of cases of nonspecific obstruction, especially those with erythroblastosis, tends to clear with the passage of time, either spontaneously or with cholagogue therapy. In some cases, operative irrigation of the extrahepatic biliary system with normal salt solution introduced via the gallbladder has been considered to be of some value. However, the indications for exploration, either to rule out the presence of atresia or for therapeutic purposes, are by no means settled. Other causes of obstructive neonatal jaundice are quite rare indeed, and, for practical purposes, obstructive jaundice in the newborn may be considered to be due to extrahepatic biliary atresia or to the *inspissated bile* syndrome.

Although there may be some question concerning the advisability of operative intervention for the nonspecific type of obstruction, it is well established that the only hope in cases of extrahepatic atresia lies in surgical relief of the obstruction. Patent extrahepatic biliary remnants which communicate with the intrahepatic biliary system and can be used for anastomosis with the proximal intestinal tract are found in approximately 20 per cent of the cases. Nonetheless, reports of successfully treated cases are still a rarity. It is significant that virtually all of the surviving patients were operated upon during the early weeks of life. The operation is a relatively simple one and the mortality rate should be low. Ladd and Gross have demonstrated quite brilliantly in numerous publications that, with careful preoperative and postoperative management and meticulous surgical technic, operations can be done in the neonatal period with surprising safety. It is to be presumed that the scarcity of recorded successes results more from the postponement of corrective surgery into a period of greater hazard than from operative fatalities in infants properly treated in the early weeks of life.

The average duration of life in patients with unrelieved extrahepatic atresia has been reported as ranging from five to seven months. Yet, in a recent study it was found that the average age at which patients with atresia were first seen at a university hospital was $4\frac{1}{2}$ months, an age well into the period of irreversible hepatic damage from biliary cirrhosis. The tragedy of such delay is quite apparent. Microscopic evidence of portal changes in the form of round cell infiltration, fibrosis and bile duct proliferation appears relatively early and seems to be well established by 2 months of age. Nonetheless, some of the tests of liver function show remarkably little abnormality until death is near. It is undoubtedly true that a significant number of patients with atresia correctable by contemporary standards are lost because of unnecessarily long postponement of exploration.

The status of the majority of patients with atresia—those who have no extrahepatic ducts in communication with the intrahepatic biliary system—remains grave. The atresia in these cases is generally classified as noncorrectable or *inoperable* and the outcome has been uniformly fatal. Since associated intrahepatic biliary atresia is encountered in only a very small percentage of these patients, the possibility exists that some means of achieving hepatic biliary decompression ultimately may be shown to be practicable. The use of an anastomosis of a Roux-Y limb of jejunum to a cut surface of liver has been suggested. However, a number of problems remain to be solved. If it can be shown that there is hope for some of the infants with *noncorrectable* atresia, the importance of early operation will be even greater in these patients than in those of the correctable type.

Although many significant advances have been made in recent years in the study of obstructive neonatal jaundice, much work remains to be done. The spontaneous clearance of jaundice in many cases of nonspecific obstruction has served to confuse the picture somewhat with respect to the time and indications for exploration. Until the clinical differentiation between nonspecific obstruction and extrahepatic biliary atresia becomes more clearly defined, early operation should be done when there is a reasonable suspicion that the obstructive jaundice is due to atresia of the bile ducts.

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BOOK REVIEWS

The editors of THE AMERICAN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.

Pathology in Surgery. By EDWIN F. HIRSCH, Ph.D., M.D., Director of the Henry Baird Favill Laboratory; Pathologist of St. Luke's Hospital, Chicago, Illinois; Research Associate, Associate Professor (Emeritus) of the Department of Pathology of the University of Chicago. Baltimore, The Williams & Wilkins Company, 1953. \$10.00.

The author of this text has written a surgical pathology with marked emphasis on illustration of the material presented. His arrangement of material is good, being by systems, rather than by pathologic processes. In his preface the author strongly advocates the use of photographs in the permanent records of a department of pathology.

The coverage of the material from a textual aspect is somewhat inadequate, being limited largely to gross and microscopic descriptions of disease processes. There is little information concerning the natural history of pathologic entities, life expectancy, relative incidence of tumors or surgical mortality and morbidity.

The photographs and photomicrographs are the outstanding feature of this book. These are excellent. They are the best monochrome illustrations the reviewer has seen assembled. The two color plates strike a jarring note, and might better have been omitted.

It is doubtful if this book will be very useful to the practicing surgeon or the surgical resident due to its omission of clinical material, but for the student, during his first surgical experience, it would be very valuable.

THOMAS G. ORR, JR., M.D.

BOOKS RECEIVED

Books received are acknowledged in this section, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

The Collected Papers of the Mayo Clinic and the Mayo Foundation. Volume XLIV. Edited by RICHARD M. HEWITT, B.A., M.A., M.D., A. B. NEVLING, M.D., JOHN R. MINER, B.A., Sc.D., JAMES R. ECKMAN, A.B., M.A., Ph.D., M. KATHARINE SMITH, B.A., CARL M. GAMBILL, A.B., M.D., M.P.H., FLORENCE SCHMIDT, B.S.E., and GEORGE G. STILLWELL, A.B., M.D. Philadelphia and London, W. B. Saunders Company, 1953.

Rose and Carless' Manual of Surgery. Eighteenth Edition. By SIR CECIL WAKELEY, B.T., K.B.E., C.B., LL.D., M.Ch., D.Sc., F.R.C.S., F.R.S.E., F.R.S.A., F.A.C.S., F.R.A.C.S., Fellow of King's College, London, President of the Royal College of Surgeons of England, Senior Surgeon, King's College Hospital; Director of Surgical Studies and Lecturer in Surgery, King's College Hospital Medical School; Surgeon, Belgrave Hospital for Children and Royal Masonic Hospital; Consulting Surgeon to the Royal Navy; Examiner in Surgery to the University of Cambridge; Formerly Examiner to the Universities of London, Glasgow, Durham, Sheffield, Wales and Ireland. Baltimore, Maryland, The Williams & Wilkins Company, 1952. \$12.00.

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